CHAPTER 2.0
BACKGROUND ON LOS ALAMOS NATIONAL LABORATORY FACILITIES AND ACTIVITIES

This chapter provides a description of the activities and facilities at LANL. The chapter includes a description of the 49 technical areas and focuses on the activities at 15 key facilities. The role of the University of California in LANL's operation and recent funding levels are also presented.

LANL's current activities stem from its original mission to build the world's first nuclear weapon. In March 1943, a small group of scientists led by J. Robert Oppenheimer, came to the small community of Los Alamos to carry out Project Y of the Manhattan Project (1943 through 1945).

Although the original mission was assigned to a few hundred scientists and technicians, by the time the first nuclear bomb was tested at Trinity Site, the Los Alamos Laboratory consisted of more than 3,000 civilian and military personnel. In 1947, Los Alamos Laboratory was renamed the Los Alamos Scientific Laboratory, and in 1981 it was designated as a national laboratory and became LANL. Following World War II, LANL activities continued to focus on nuclear defense and related research and development, but gradually expanded to include nuclear energy and other high-technology civilian research and development, and over time grew to serve other government and civilian programs.

This chapter provides an overview of LANL's activities, both direct-funded (section 2.1.1) and support activities (section 2.1.2). It includes a discussion of responsibilities associated with operational safety at LANL (section 2.1.3). It also provides a description of LANL's technical areas (TAs) (section 2.2.1), the 15 facilities that were identified as key facilities for purposes of the SWEIS (section 2.2.2), and identification of nuclear and moderate hazard non-key facilities (section 2.2.3). Sections 2.3 and 2.4 discuss the role of the University of California (UC) at LANL and recent LANL funding levels, respectively.

2.1 OVERVIEW OF LANL ACTIVITIES

The mission assignments and programs at LANL are discussed in chapter 1. However, the essence of operations at LANL lies in its various research and development and some fabrication activities, as well as the support activities. These serve as the foundation upon which new assignments and tasks build and rely. These activities are described in this section.

LANL is funded primarily to use its capabilities in undertaking a broad range of theoretical and experimental research and development, as well as several production activities, for DOE and other federal agencies (these are referred to as direct-funded activities). Various support activities throughout LANL are essential to these undertakings.

Research and development activities are dynamic by their very nature, with the norm being continual change within the limits of facility capabilities, authorizations, and operating procedures. This section describes the direct-funded activities at LANL in three (overlapping) major areas:

- Theory, modeling, analysis, and computation (section 2.1.1.1)

- Experimental science and engineering (section 2.1.1.2)
- Advanced and nuclear materials research, development, and applications (section 2.1.1.3)

In addition, this section describes the support services needed to operate the site, such as site-wide management activities and ecological and natural resource management.

2.1.1 Categories of Direct-Funded Activities

The operations of LANL are diverse and dispersed throughout the large government reservation. A general description of the types of direct-funded activities undertaken at LANL can be summarized as follows.

2.1.1.1 *Theory, Modeling, and High Performance Computing*

This class of research and development includes theoretical activities that are primarily directed toward model development, analysis, and assessment. Individual research activities integrate basic theory and experimental data across multiple disciplines into realistic analytical and simulation models; analyze and validate the models through comparison with experiments (including dynamic and hydrodynamic tests) and other expert information; or integrate the models into computer programs for the assessment of complex systems. Examples of such complex systems include weapons performance and surety, energy systems, military systems, transportation, atmosphere and ocean environments, manufacturing and materials processes, nuclear facility performance and safety, and health system analysis. Another aspect of LANL activities of this type is fundamental theory in areas such as nuclear and particle physics, astrophysics, biology, plasma and beam physics, and materials.

Theory, modeling, and high-performance computing combines fundamental theory and numerical solution methods with high-performance computing to model a broad range of physical, chemical, and biological processes.

The operations supporting theory, modeling, and high-performance computing present risks similar to those of commercial or university administrative and research facilities; these are typically risks of industrial accidents/incidents.

2.1.1.2 *Experimental Science and Engineering*

Experimental science and engineering undertaken at LANL ranges from small-scale laboratory experimental activities and testing to the operation of one-of-a-kind facilities for measurements with radioactive, explosive, and hazardous materials and processes.

Experiments are conducted in nuclear and particle physics, astrophysics, chemistry, atomic and plasma physics, accelerator technology, hydrodynamics, laser science, and beam physics, as well as a wide range of technology applications of neutron scattering, transmutation technologies, plasma processing, radiography, microlithography, inertial fusion, and Earth and environmental sciences. The capability includes integrating theory and modeling with measurements from experiments that are made using a wide variety of instruments and techniques over a range of physical conditions.

These activities often utilize energy sources such as accelerators, high-powered lasers, high explosives, and pulsed-power systems. For example, Atlas and Pegasus-II provide pulse power for initiating hydrodynamic and other experiments and are located at TA–35, as is the Trident laser. (Atlas was analyzed in a project-specific appendix to the *Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management* (SSM PEIS)

[DOE 1996a, Appendix K]). Many smaller lasers and pulsed-power devices are used throughout LANL. Analysis related to these types of experiments is conducted at several locations throughout LANL and supports further theoretical development.

The hazards associated with experimental science and engineering work are primarily due to the presence of energy sources, such as lasers, explosives, accelerator beams, and electricity. These energy sources pose the risk of injury or death to workers; however, they pose minimal risk to the public because the public does not have access to the energy sources. Other risks associated with this type of work are similar to industrial, administrative, and research work and could result in accidents/incidents. Specific experiments that use radioactive or other hazardous materials also involve risk to workers and to the public associated with exposure to such materials. (Public risk is associated with the radioactive and hazardous contents of effluents and emissions.)

A similar energy source at LANL is a very high powered radiofrequency source called the "Antenna Test and Calibration Range," which is an outdoor test range at TA–49. As with lasers and other energy sources, the primary hazards associated with this type of work are due to the energy sources (which pose a risk to workers) and other hazards typical of industrial, administrative, and research work that could result in accidents/incidents. Specific experiments that use radioactive or other hazardous materials also involve risk to workers and to the public associated with exposure to such materials.

2.1.1.3 *Advanced and Nuclear Materials Research, Development, and Applications*

These activities include those which are theoretical and experimental in nature, but because they are often focused on hazardous and nuclear materials, may require unique facilities and equipment.

Advanced materials include energetic materials (such as high explosives and detonators), hazardous materials (such as beryllium and toxic organics), and structural materials (such as high load-bearing metals and metal alloys, intermetallic compounds, ceramics, and certain organics such as plastics and polymers). Nuclear materials include highly enriched uranium, tritium, and transuranics (including plutonium). These materials are used both in weapons and nonweapons research, development, and applications.

Activities under this category include research regarding the nature of materials, for example:

- Physical and chemical behavior in a variety of environments
- Development of technologies for handling and processing hazardous and nuclear materials
- Development of fabrication technologies
- Development of measurement and evaluation technologies

In addition, the activities in this area include casting, forging, extruding, drawing, forming, and machining materials, including metals, ceramics, polymers, and electronic materials of many types in both bulk and thin film forms into complex shapes over a range of sizes. Applications include: complex electronic materials development and characterization; development and use of thin films, coatings, and membranes; and fabrication of components for nuclear weapons (e.g., for primaries, gas reservoirs, and secondaries) or mock-ups of such components and parts for research on the behavior of materials.

The hazards associated with this type of work are those associated with energy sources (as discussed in section 2.1.1.2 above), industrial accidents/incidents, exposure to hazardous materials, and exposure to radioactive materials. While all of these hazards could affect workers, hazardous and radioactive constituents in emissions and effluents, and radiation exposures associated with the handling of nuclear materials also have the potential to affect the public and the environment.

2.1.2 Supporting Activities

As with the research and development activities across LANL, many of the support activities and infrastructure of LANL have varied within a range of activities. Such activities are expected to continue with similar variance under all of the SWEIS alternatives. In addition, renovations and some increased power, water, and natural gas supplies will be required regardless of which alternative is chosen.

These supporting activities, which are not expected to change among the alternatives, are:

- Most aspects of site-wide waste management
- Infrastructure and central services
- Facility maintenance and refurbishment
- Environmental, ecological, cultural, and natural resource management; and environmental restoration, including decontamination and decommissioning

These activities are crucial to LANL's capabilities in supporting its assigned missions. However, these activities present minimal risk to the public and the environment, and the risks posed to workers are similar to those in any research laboratory (the site-wide consequence analyses do include the contribution of these operations). These activities are described below.

2.1.2.1 *Waste Management*

Waste treatment, storage, and disposal, although not the primary business at LANL, are central to all facilities and TAs within LANL. Sewage wastes and industrial solid (nonhazardous under the *Resource Conservation and Recovery Act* [RCRA]) wastes at LANL are managed similarly to commercial and municipal practices for these wastes throughout northern New Mexico (including use of sewage treatment plants and landfills). These are discussed in section 4.9.3 and are not elaborated upon further here. Radioactive and chemical wastes that result from LANL operations receive treatment in accordance with regulatory requirements and are stored for off-site disposal or are disposed of in designated sites at LANL.

DOE directed the preparation of waste management strategies for treatment, storage, and disposal of LANL-generated radioactive and hazardous chemical waste (*Waste Management Strategies for LANL*, LANL 1998b). The current strategy at LANL is characterized by utilization of existing on-site capabilities and cost-effective treatment and disposal. In addition, DOE also considered two other strategies: minimizing the on-site treatment and disposal and maximizing the on-site treatment and disposal. In *Waste Management Strategies for LANL*, these three strategies are applied (to the extent practicable) to each radioactive and chemical waste type generated at LANL for the volumes of waste projected under each SWEIS alternative. Additionally, each waste type is subdivided into treatability groups (groupings of waste types that would undergo similar treatment and disposal activities). Specific plans for treatment and disposal of LANL-generated waste are presented in *Waste Management Strategies for LANL* for each waste type by treatability group (LANL 1998b).

Only the current strategy is carried through the SWEIS alternative descriptions and analyses, for all waste types across the alternatives. An examination of the changes caused by employing these different strategies did not reveal any deciding factors that would cause a change in the current strategy for most waste streams. Low-level radioactive mixed waste (LLMW) (which is a mixture of hazardous and low-level radioactive waste [LLW]) is primarily shipped off the site for treatment and disposal, with minimal on-site treatment. LANL is a minor user of these off-site facilities, and no capacity constraints have been noted. A change in this strategy would require the development of on-site treatment and disposal capability, which is not currently envisioned. Should conditions change such that a specific proposal might become viable in the future (such as a substantial change in waste volume [e.g., if LANL were chosen as a regional disposal site for LLMW disposal, as discussed in chapter 1, section 1.5.1] or type), an analysis would be done at that time. Transuranic (TRU) waste is treated on site and stored pending shipment to the Waste Isolation Pilot Plant (WIPP), consistent with recent DOE decisions (discussed in SWEIS sections 1.5.1 and 1.5.3). LLW is the only waste type where more than one viable strategy exists, and those options are evaluated in this document. The limited disposal space remaining in Area G, and the potential effects of the Waste Management Programmatic Environmental Impact Statement (WM PEIS) Record of Decision (ROD), causes DOE to evaluate the effects of expanding Area G or pursuing a strategy of shipping LLW off the site. The differences in these strategies are reflected in the differences between the alternatives (Expanded Operations is the only alternative that includes expansion of Area G). The project-specific siting and construction (PSSC) analysis for the expansion of Area G in volume II of this document reflects siting and construction alternatives for on-site disposal of LLW.

The principal radioactive and hazardous chemical waste management facilities at LANL are located at TA–50 and TA–54. A wide variety of waste types are managed at these facilities, and these wastes are generated in gaseous, liquid, and solid forms throughout LANL. These include administratively controlled industrial solid wastes, toxic wastes, hazardous wastes, LLW, TRU wastes, and mixtures of the above (e.g., radioactively contaminated asbestos, which is a toxic radioactive waste). The management of these wastes requires many different activities, including waste minimization, waste characterization, volume reduction, and waste treatment, storage, and disposal operations. Detailed analyses of the waste management operations across the SWEIS alternatives are focused on those activities conducted at TA–50 and TA–54. All other waste management activities (outside of those performed in these two facilities) are not expected to change among alternatives.

Pollution prevention programs are common to all alternatives as well. These programs have been successful in reducing overall LANL wastes requiring disposal by 30 percent over the last 5 years. These programs are site wide but have facility-specific components, especially for the larger generators of radioactive and hazardous chemical wastes. Waste projections developed by alternative reflect only demonstrated waste minimization and pollution prevention improvements. Past reductions, however, indicate that this is a conservative assumption and that actual waste generated in the future should be less than that projected. The *Site Pollution Prevention Plan for Los Alamos National Laboratory* (LANL 1997a) describes the LANL Pollution Prevention and Waste Minimization Programs, as well as general program descriptions, recently implemented actions, specific volume reductions due to recent actions, and current development/demonstration efforts that have not yet been implemented.

The DOE Stockpile Management Process Development Program also plays an important role in pollution prevention. This program assures the improvement of current production processes for regulatory compliance and efficiency and the development of processes expected to be used for future production.

Numerous initiatives have been and are currently being funded through this program, which will minimize the waste being generated from production activities. Additional initiatives are anticipated in the upcoming years, which will result in avoidance of TRU and mixed TRU waste at the point of generation. Process Development Program tasks associated with waste minimization include electrorefining and molten salt extraction processing, glovebox decontamination, supercritical carbon dioxide cleaning development, chloride solvent extraction, enhanced waste immobilization, nitric acid recycle and nitrate destruction, density measurement technology, in-line TRU waste assay and packaging, plutonium machining development, reusable coated metal molds for casting, and plutonium die casting.

As with the pollution prevention program, the SWEIS waste projections only take credit for demonstrated technologies; actual waste generation should continue to be reduced due to this program. A description of the major stockpile management waste reduction initiatives is included in the *Waste Minimization Activities for Pit Production at LANL* (LANL 1996a).

2.1.2.2 *Infrastructure and Central Services*

LANL has 2,043 structures containing 7.9 million square feet (734,700 square meters), of which 1,835 are buildings, totaling 7.3 million square feet (678,900 square meters). The other structures consist of such items as meteorological towers, pumphouses, water towers, manhole covers, and small storage sheds. According to LANL's Fiscal Year (FY) 1997–2002 Institutional Plan (LANL 1996b), administration occupies 25 percent of LANL space, and storage and services (including power facilities) occupy approximately 20 percent (Figure 2.1.2.2–1). In other words, central services and infrastructure use almost half of LANL's facilities and space. These activities include:

- *Administrative/Technical Services*—Facilities used for support functions that include the Director's Office; Business; Human Resources; Facilities, Security and Safeguards; Environment, Safety, and Health; and communications.
- *Public/Corporate Interface*—Facilities, both restricted and unrestricted, that allow public and corporate access and use, including such facilities as the Oppenheimer Study Center, Bradbury Museum, and special research centers.
- *Physical Support and Infrastructure*—Facilities used for physical support of other laboratory facilities. These include warehouses, general storage, utilities, and wastewater treatment.

The natural gas and electric power needs at LANL are interdependent and are presented in this SWEIS by alternative. Options to meet the increased capacity, as well as reliability needs, are being studied and involve multiple organizations and communities in the area. Beyond simple maintenance and replacement as needed for components of these systems, a project-specific NEPA review will be conducted when sufficient definition for the specific options to meet projected needs has been developed.

While demand for water and electricity differs among alternatives, there are no changes proposed in this SWEIS with respect to DOE operations to provide and distribute these resources at LANL. Thus, these operations do not change across the alternatives analyzed and are included in all alternatives.

2.1.2.3 *Maintenance and Refurbishment*

LANL facilities have an estimated replacement cost of $4.2 billion, which includes buildings,

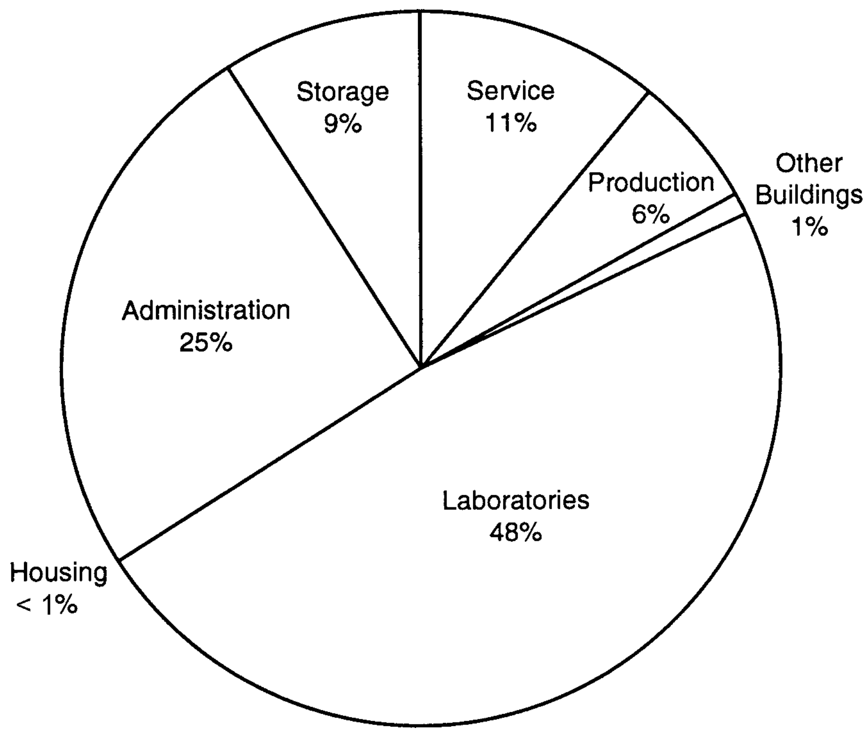


FIGURE 2.1.2.2–1.—*Gross Space Utilization by Function.*

infrastructure, and capital equipment. Many of the facilities at LANL are essential for DOE to meet mission requirements.

Many of the existing LANL facilities and equipment are approaching, or have already exceeded, their design life. Thus, the activities and cost to maintain these facilities and upgrade them to current standards are increasing. Currently, approximately 30 percent of laboratory facilities are more than 40 years old, with close to 80 percent of LANL facilities more than 20 years old. The 20-year design life of a facility is considered the standard age at which facility maintenance and operating costs significantly increase.

Many of these facilities are or soon will be one-of-a-kind in the consolidated DOE complex. Thus, their continued availability is essential for DOE to meet its mission requirements. Examples of the routine maintenance and refurbishment activities necessary to accomplish this and that are now underway or planned for each of the alternatives include:

- Maintaining and extending on-site roads and parking areas
- Replacing apparatus and components such as pumps and filters to retain and improve the performance and extend the usefulness of buildings and equipment
- Cleaning, painting, repairing, and servicing buildings, utility lines, and equipment
- Routine decontamination of equipment and facilities
- Erecting, operating, and demolishing support structures
- Relocating and consolidating equipment and operations from one building or area to another where similar activities are being performed
- Placing facilities in a safe shut-down condition when they will not be used for some time, if ever

DOE and LANL have the responsibility to upgrade buildings and equipment in order to protect the health, safety, and comfort of the operating personnel, the general public, and the environment (as discussed in section 2.1.3). Although these upgrades are often made in response to changed regulations, they are also made as proactive changes to prevent deterioration. These activities generally do not individually or collectively have significant impacts to the environment. These are accomplished within the organized framework of the laboratory support organization, including the waste management system. Typically, these upgrades are made in and around existing buildings, in developed areas, and along existing roadways. Examples of upgrades to enhance health, safety, and environmental protection include:

- Installing and maintaining high efficiency particulate air (HEPA) filters in work enclosures and building air exhaust systems
- Installing detection and emergency equipment such as radiation monitors, wash stations, and alarms
- Removing hazardous, toxic, and radioactive materials from buildings and areas to protect worker health and the environment
- Regrading, contouring, and revegetating disturbed areas
- Cutting and clearing fire protection buffers around facilities

Some of the typical maintenance and refurbishment projects at LANL are specific to the protection of the facilities, equipment, information, and materials located at LANL. There are specific upgrades being undertaken at LANL facilities to ensure compliance with safeguards and security requirements of DOE. Typically, these include replacement of equipment with similar items, upgrades to remove obsolete equipment, and upgrades to incorporate state-of-the-art technology. Those upgrades that are common to all SWEIS alternatives are those that need to be implemented in order to maintain the viability of existing facilities and ensure the availability of existing capabilities. Upgrades required for all alternatives for continued operations include:

- New security host systems (computer and software) including replacing some communications systems
- Replacement of sensors in Perimeter Intrusion Detection and Alarm Systems
- Installation of required alarms and access control panels

2.1.2.4 *Environmental, Ecological, and Natural Resources Management Activities*

DOE is responsible for the natural resources at LANL as a Natural Resources Trustee (DOE 1996d). In order to fulfill this responsibility, DOE and UC, as the DOE management and operating contractor for LANL, are implementing a Natural Resources Management Program integrating the ongoing natural resources management activities at LANL, which include:

- *Biological Management*—Includes research and characterization of biological resources (e.g., nongame and game species, wetlands and vegetation), habitat stabilization and renovation as necessary, and wildlife management.
- *Forest Management*—Addresses wildfire prevention, forest condition assessment, forest maintenance (including thinning and controlled burns), and firewood sales.
- *Threatened and Endangered Species Habitat Management*—Implements DOE responsibilities under the requirements of the *Endangered Species Act*, including species surveys and monitoring, habitat characterization and delineation, and implementation of project-specific mitigation and management measures, as needed.

- *Groundwater Protection*—Activities emphasize monitoring and characterization of groundwater resources, including the installation and maintenance of wells throughout LANL, sampling, analysis and characterization of quantities and qualities of groundwaters.
- *Watershed Management*—Activities include installation and maintenance of surface water monitoring stations, routine sampling and characterization, and surface water drainage stabilization and maintenance.
- *Air Quality Management*—Activities include installation of equipment and monitoring of stack emissions, ambient air quality monitoring stations, and air quality sample collection and analysis.

Results of these ongoing programs are reported in the LANL annual surveillance reports and other LANL documents. In addition, there are numerous small-scale research and development activities seeking to quantify the transport, fate, and effects of contaminants from historical LANL operations on environmental media and biological receptors. Some of these research and development activities are associated with the LANL Environmental Restoration Project.

Natural resources management activities are included in the site-wide analysis contained in all alternatives. These efforts are generally nonintrusive monitoring and surveillance activities that result in little disturbance to the environment. Construction activities for new wells or sampling stations undergo NEPA review as they are identified and proposed for development.

2.1.2.5 *Environmental Restoration*

Areas of known or suspected contamination resulting from past operations (i.e., legacy contamination) are being addressed by the Environmental Restoration (ER) Project. The ER Project at LANL was established by DOE in 1989 to assess and remediate potentially contaminated sites that either were or still are under LANL control. In 1996, the DOE Office of Environmental Management (EM) initiated a complex-wide strategy to accelerate site cleanup and enhance performance of the cleanup program. The national strategy focuses in particular on completing as much work as possible by the end of fiscal year 2006. Known as *Accelerating Cleanup: Paths to Closure* Report (DOE 1998b) (previously known as "2006 Plan"), it includes input from all major field sites, including LANL, to support EM's program planning process.

The ER Project is ongoing and its implementation is unaffected by the changes examined in the four alternatives in the SWEIS. The ER Project is included in all alternatives.

The primary objectives of LANL's ER Project are: (1) to protect human health and the environment from exposure to releases of wastes; (2) to meet the environmental cleanup requirements of the Hazardous and Solid Waste Amendments Module VIII of LANL's permit to operate under RCRA; (3) to conduct closure of historical treatment, storage, and disposal facilities; and (4) to decommission contaminated facilities considered to be surplus.

The ER Project provides formal and informal mechanisms through which stakeholders can participate in this corrective action process. NEPA review of corrective actions is performed as soon as enough information is available to make a meaningful determination on the appropriate level of review or analysis. These analyses, in combination with the remediation plans, are available to the public for review.

About 2,120 potential release sites (PRSs) have been identified at LANL by the ER Project. These sites are a combination of potential solid waste management units identified in the RCRA permit for LANL and potentially contaminated sites called "areas of concern," which may contain hazardous substances, such as radionuclides, that are not regulated under RCRA. As of September 1997, 1,370 of these sites had been identified as requiring no further action based on human health concerns; these sites will be reviewed in the future for ecological concerns. Included in these ecological concerns are threatened and endangered species.

The *Accelerating Cleanup: Paths to Closure* document (DOE 1998b) includes a schedule for the cleanup of the remaining approximately 700 to 750 sites. This schedule encompasses a period of 10 years, beginning with fiscal year 1998 and ending in fiscal year 2008. The number of cleanups per year varies from approximately 18 in fiscal year 2008 to 100 in fiscal year 2002. An important and integral part of the cleanup methodology and the need for any interim protection measures is ecological risk, which, again, includes threatened and endangered species. The location of threatened and endangered species, their habitat, or potential habitat in relation to these sites is an integral part of the site cleanup prioritization process.

Prior to 1994, the PRSs were organized into 24 operable units (OUs), for which RCRA Facility Investigation (RFI) work plans were written. In an effort to streamline the characterization and remediation process at LANL, the OUs were grouped into five field units (FUs). A sixth FU includes all of the Decommissioning Project areas. Geographic locations of the OUs are shown on Figure 2.1.2.5–1. While OUs are no longer used, they have been used in the recent past and in some of the documents used as references in the SWEIS. Table 2.1.2.5–1 presents the relationships between FUs, OUs, and TAs and the waste types that could be generated during characterization and remediation activities (note that Figure 2.2.1–1 reflects the locations of the TAs at LANL). Projection of waste types and quantities anticipated from remediation activities at the LANL PRSs over the lifetime of the ER Project (approximately the next 10 years) are included in the total waste projections for each of the SWEIS alternatives.

The LANL PRSs are diverse and include past material disposal areas (landfills), canyons, drain lines, firing sites, outfalls, and other random sites such as spill locations. The primary mechanisms for contaminant release from the ER sites are surface-water runoff carrying potentially contaminated sediments and soil erosion exposing buried contaminants. The main pathways by which released contaminants can reach off-site residents are through infiltration into alluvial aquifers, airborne dispersion of particulate matter, and sediment migration from surface-water runoff. The contaminants involved include volatile and semivolatile organics, polychlorinated biphenyls (PCBs), asbestos, pesticides, herbicides, heavy metals, beryllium, radionuclides, petroleum products, and high explosives.

Since 1990, LANL's ER Project has conducted over 100 cleanups. The ER Project has also decommissioned over 30 structures and conducted three RCRA closure actions during this period. Some major decommissioning activities are listed in Table 2.1.2.5–2. During these actions, no significant worker health and safety occurrences or environmental reportable incidents (contaminant releases) were reported.

DOE provides for surveillance, maintenance, decontamination, and decommissioning services for LANL's contaminated surplus or abandoned facilities following DOE guidelines and applicable regulations. The project's goal is to ensure that future programmatic uses of remaining facilities or surrounding areas are permitted without restriction. Major decontamination and decommissioning activities scheduled for completion in the next 10 years are shown in Table 2.1.2.5–3.

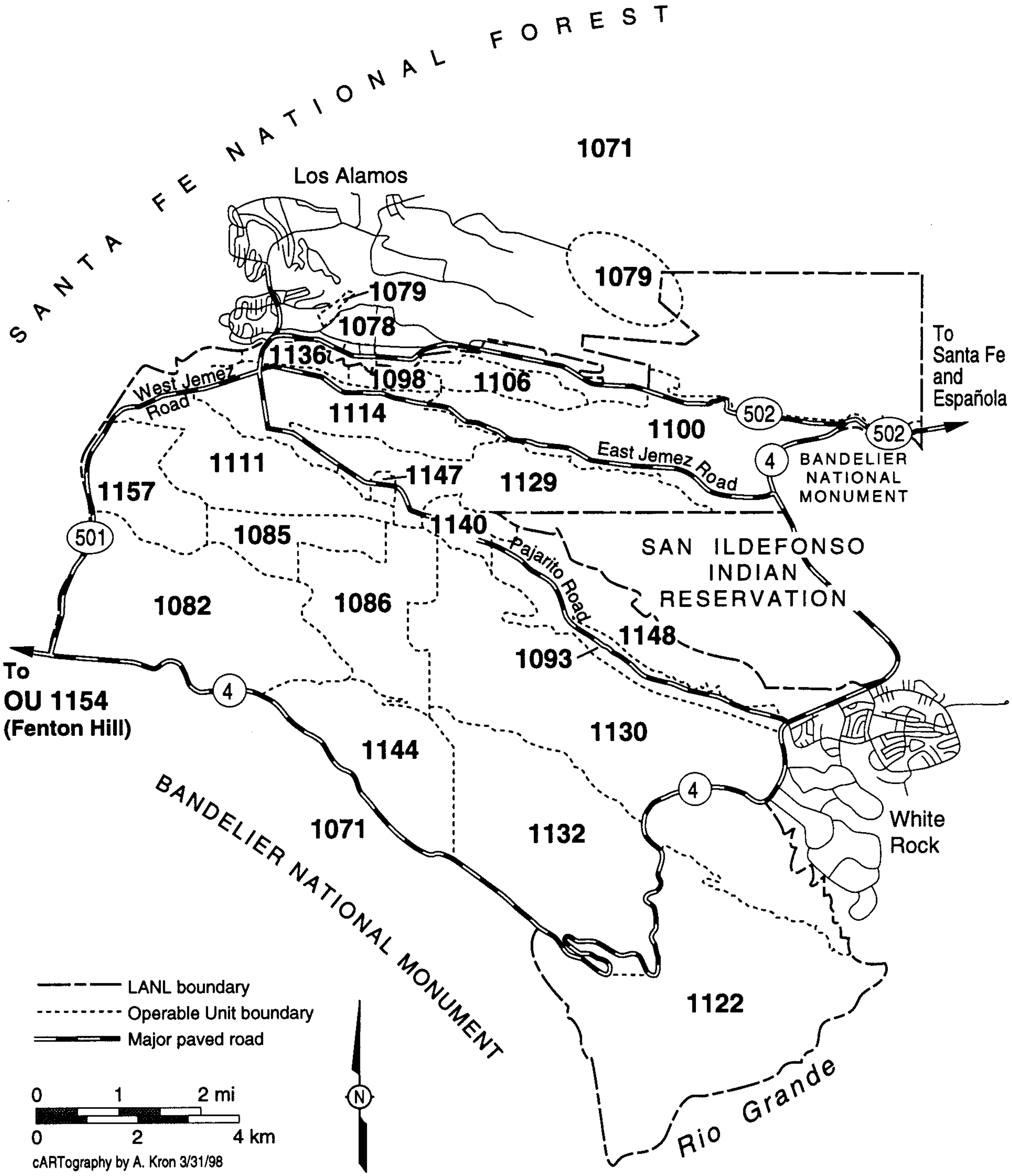


FIGURE 2.1.2.5–1.—*Geographic Locations of the Operable Units.*

TABLE 2.1.2.5–1.—*Summary of Environmental Restoration Project Field Units, Technical Areas, Operable Units, Potential Contaminants, and Waste Types Generated During Characterization/Remediation*

ER FIELD UNIT	LOCATION (TECHNICAL AREAS AND OPERABLE UNITS)	ENVIRONMENTAL RESTORATION SITES	CONTAMINANTS OF CONCERN	WASTE TYPES TO BE GENERATED DURING CHARACTERIZATION REMEDIATION
1	*TAs* 0, 1, 3, 10, 19, 21, 26, 30, 31, 32, 43, 45, 59, 60, 61, 64, 73, and 74 *OUs* 1071, 1078, 1079, 1106, 1114, and 1136	Consist of 664 potential release sites at Los Alamos townsite, old plutonium processing facility, municipal sanitary landfill, and historic land areas	High explosives, volatile and semivolatile organics, PCBs, asbestos, pesticides, heavy metals, radionuclides, and petroleum products	RCRA organics, RCRA metals, LLW, PCBs, industrial, sanitary, LLMW
2	*TAs* 12, 14, 15, 18, 20, 27, 36, 39, 53, 65, 67, 68, 71, and 72 *OUs* 1085, 1086, 1093, 1100, 1130, and 1132	Consist of 301 potential release sites all within DOE-controlled land at active/inactive firing sites, nuclear criticality research facility, and 0.5-mile (0.8-kilometer) long linear proton accelerator	Radionuclides, high explosives, organics, and heavy metals	RCRA organics, RCRA metals, LLW, LLMW
3	*TAs* 11, 13, 16, 24, 25, 28, 33, 37, 46, and 70 *OUs* 1082, 1122, and 1140	Consist of 555 potential release sites all within DOE-controlled land used for development and processing of high explosives and reactor components	High explosives, volatile and semivolatile organics, PCBs, asbestos, pesticides, herbicides, and radionuclides	RCRA organics, RCRA metals, LLW, PCBs, industrial, LLMW
4	*TAs* 2, 4, 5, 35, 41, 42, 48, 52, 55, 63, 66, and Canyons *OUs* 1049, 1098, and 1129	Consist of 260 potential release sites including 110 miles (177 kilometers) of canyon systems, reactor site, and other sites within DOE-controlled land	Radionuclides, high explosives, volatile and semivolatile organic compounds, and inorganics including heavy metals	RCRA organics, RCRA metals, LLW, LLMW
5	*TAs* 6, 7, 8, 9, 22, 23, 40, 49, 50, 51, 54, 57, 58, 62, and 69 *OUs* 1111, 1144, 1147, 1148, 1154, and 1157	Consist of 313 potential release sites including explosives development areas, major waste management areas, and the Fenton Hill geothermal site in the Jemez Mountains	Radionuclides, high explosives, volatile organic compounds, and metals	RCRA organics, RCRA metals, LLW, industrial, sanitary, asbestos, LLMW, TRU, mixed TRU
6	All TAs where surplus facilities are located	Facilities considered excess or surplus including the TA–35 Phase Separator Pit, TA–21 DP West Site, TA–33 Tritium Facility, TA–16 High Explosives Areas	Tritium, low-level radionuclides, asbestos, heavy metals, acids, volatile and semivolatile organics, high explosives	RCRA organics, RCRA metals, LLW, asbestos, LLMW, TRU, high explosives, mixed TRU

TABLE 2.1.2.5–2.—*Major Decommissioning Activities Completed to Date at LANL*

LOCATION	DECOMMISSIONING ACTIVITY	YEAR
TA–33–21	Disposition of a plutonium-contaminated experimental facility	1975
TA–21–12	Demolition of a plutonium filter facility	1975
TA–21–153	Decommissioning of an actinium-contaminated filter building	1981
TA–35	Decommissioning of the Los Alamos Molten Plutonium Reactor Experiment (LAMPRE I)	1981
TA–35	Decommissioning of a titanium-contaminated laboratory	1981
TA–35–7	Removal of contaminated air scrubbers	1981
TA–42	Decommissioning of a plutonium-contaminated incinerator facility	1981
TA–21	Decontamination of plutonium facility at DP West	1982
TA–3 to TA–50	Removal of radioactive liquid waste lines parallel Diamond Drive and Pajarito Road	1986
TA–2	Decommissioning of the water boiler reactor	1991
TA–52	Decommissioning of a reactor facility	1991
TA–35	Decommissioning of the Los Alamos Power Reactor Experiment (LAPRE II)	1991
TA– 35	Phase separator pit	1997

TABLE 2.1.2.5–3.—*Future Decommissioning Activities at LANL*

LOCATION	DECOMMISSIONING ACTIVITY	COMPLETION YEAR
TA–16	Certain high explosives areas at S-Site	2007
TA–21	Decommissioning of TA–21, DP West Site	2004
TA–33	Building 86, Tritium Facility	1999

2.1.3 Responsibilities for Safe Operations at LANL

This section describes the responsibilities for the safe operation of LANL, with a focus on nuclear facilities, as well as the policies and procedures in place to establish an understanding of the hazards and risks associated with these operations; to control operations such that workers, the public, and the environment are protected; and to improve safety performance and reduce the risks associated with the operation of LANL. This section provides an overview of these topics; other documents are cited that provide more comprehensive discussions.

DOE performs much of its work through its contractors. Therefore, the day-to-day responsibility for safe operation of nuclear facilities has also been delegated to contractors (e.g., UC at LANL). Through this delegation, the responsibility becomes shared but not relinquished by DOE. DOE line managers are responsible for assuring the safety of operations assigned to them, and this responsibility is delegated in part to contractors through formally established policies, programs, and processes.

There are numerous processes and levels of oversight for operations in existing nuclear facilities, for upgrades or changes to operations in existing nuclear facilities, and for start/restart of operations in existing or new nuclear facilities. All operations in DOE nuclear facilities are conducted only with authorization by DOE to operate. The form of DOE authorization is determined based on the hazard of the operations in the facility (including types and amounts of nuclear materials) and the evaluated risk of operating the facility. These evaluations may be in the form of a safety analysis report, a safety evaluation report, a Basis for Interim Operation, or other analysis or assessment document. (These are established in DOE Order 5480.22, *Technical Safety Requirements*, and DOE Order 5480.23, *Nuclear Safety Analysis Reports*.)

Contractor line management must operate nuclear facilities in accordance with the authorized DOE safety basis. LANL also operates within a standards-based Integrated Safety Management System (currently being implemented at DOE sites, including LANL) approved by DOE and contractually binding on UC for LANL operations. This system integrates the concept of “doing work safely” by institutionalizing the planning and execution of activities with the controls necessary to ensure that environment, safety, and health objectives are achieved. The contractor has a continuing obligation under the Integrated Safety Management System, and delegated line management safety responsibility, to self-assess and self-identify safety aspects of the work process and to address potential safety concerns with existing operations. Contractor line management must continually be confident that all operations being conducted are within acceptable safety risk (as agreed to by DOE), and may take independent action to partially or completely stop operations. At any time, the contractor, either at the management level or at the worker level, may cease operations for safety (or for any other relevant concern), and review internal processes and procedures, revise them as necessary, and restart operations when corrective actions are satisfactorily completed. At times, LANL has implemented this proactive approach by temporarily suspending operations to update training, or emphasize aspects of the safety basis for operations. This has been done recently in TA–55 (in 1994) and in the Chemistry and Metallurgy Research (CMR) Building at TA–3 (1997). DOE and LANL have also temporarily suspended operations to upgrade equipment or systems to meet current standards or to improve safety performance with state-of-the-art equipment (e.g., upgrades to fire suppression systems or replacement of outdated electrical systems); these types of upgrades happen frequently and are within the realm of maintenance and refurbishment, as described in section 2.1.2.3.

At times, it is possible that the DOE understanding of the risks associated with facility operations can change substantially. This could result, for example, from a different understanding of the hazards or from new information on health effects (e.g., a new determination that a material could threaten human health in ways not previously understood, identification of seismic risks that were not previously known, or identification of potential "common cause" failures for safety systems and their backups that were not previously known). In such cases, DOE and the contractor examine the implications of this new understanding with respect to the authorization basis to determine whether operational changes, facility or equipment upgrades, or other actions are appropriate.

Changes or upgrades to operations in a nuclear facility, or identification by either DOE or the contractor of potential concerns or needed changes in the authorized safety basis, must also be reviewed under formal DOE processes. Some of these changes or issues can be addressed by the contractor, and some of these require DOE resolutions, in accordance with processes established in DOE Order 5480.21, *Unreviewed Safety Questions*. Changes or upgrades to a facility are also subject to NEPA review under 10 Code of Federal Regulations (CFR) 1021 and DOE Order 451.1A.

Formal start/restart processes are also established in DOE Order 425.1, *Start-up and Restart of Nuclear Facilities*. Criteria are established in this order for invoking the formal DOE process of starting or restarting a nuclear operation, including a formal and independent DOE readiness review process for demonstrating that a facility is safe to operate, and authorizing the start/restart.

2.1.3.1 *Defense Nuclear Facilities Safety Board*

In addition to the responsibilities of DOE and UC, the Defense Nuclear Facilities Safety Board (DNFSB) also has broad oversight responsibilities. Under its enabling statute amending the *Atomic Energy Act*, (Public Law [PL] 100-456) the DNFSB is directed to:

- Review and evaluate the content and implementation of the standards relating to the design, construction, operation, and decommissioning of defense nuclear facilities of the DOE and recommend to the Secretary of Energy those specific measures that should be adopted to ensure that public health and safety are adequately protected.
- Investigate any event or practice at a DOE defense nuclear facility which the DNFSB determines has adversely affected or may adversely affect public health and safety.
- Review the design and construction of new DOE defense nuclear facilities.
- Analyze facility design and operational data.
- Provide a meaningful opportunity for public participation in the recommendation process.

The DNFSB stays closely attuned to the planning and execution of DOE's defense nuclear programs, gathering its information from a broad range of sources, including but not limited to on-site technical evaluations by the DNFSB and its staff, critical review of DOE safety analyses by technical experts, and public meetings at headquarters and in the field.

The DNFSB has issued a number of recommendations for action as a result of its reviews and evaluations of DOE's defense nuclear activities at LANL. DOE has in the past and continues to work closely with the DNFSB and its staff to respond to these recommendations as one means of ensuring the public health and safety.

2.2 DESCRIPTION OF LANL FACILITIES

LANL is located in north-central New Mexico, 60 miles (97 kilometers) north-northeast of Albuquerque and 25 miles (40 kilometers) northwest of Santa Fe (see Figure 1.1–1 in chapter 1). LANL occupies approximately 43 square miles (111 square kilometers) of land owned by the U.S. Government and under the administrative control of DOE. Most of LANL is undeveloped to provide a buffer for security, safety, and expansion possibilities for future use.

Approximately half of LANL's square footage is considered laboratory or production space; the remaining square footage is considered administrative, storage, service, and other space (LANL 1998c). The use of LANL space by function is shown in Figure 2.1.2.2–1.

All facilities at LANL (including those proposed, under construction, pre-operational, operational, or idle; DOE owned or leased; temporary or permanent; occupied or unoccupied) have been categorized according to hazards inherent to their actual operations or planned use. LANL operations not directly associated with a facility have also been similarly categorized.

DOE has identified two major hazard categories determined by the type and quantity of radionuclide: those with a potential nuclear (radiation) hazard (called nuclear facilities) and those with nonnuclear hazard potential (called nonnuclear facilities). As part of its safety analysis process for nuclear facilities or operations, DOE performs a hazard analysis of its nuclear activities and categorizes the facilities or operations based on the inventory of radioactive materials and the potential for unmitigated or uncontrolled release of these materials.

Nuclear Facilities Hazards Classification (DOE Order 5480.23)

Category 1 Hazard*: Hazard analysis shows the potential for significant off-site consequences.*

Category 2 Hazard*: Hazard analysis shows the potential for significant on-site consequences.*

Category 3 Hazard*: Hazard analysis shows the potential for only significant localized consequences.*

For nuclear facilities, a Category 1 hazard categorization is usually applied to nuclear reactors. A Category 2 hazard categorization has been applied to facilities with potential for nuclear criticality events or that contain significant quantities of special nuclear materials (SNMs) and energy sources that could pose a risk to workers, the public and the environment on the site. Category 3, indicating potential for only localized consequences, has been applied to facilities with small quantities of SNMs. There are no Category 1 hazards or operations at LANL.

Facilities that do not meet the criteria for nuclear facilities (as defined in DOE Order 5480.23), but that still contain some amount of radioactive

Special Nuclear Material

SNM is defined in the Atomic Energy Act to mean (a) plutonium, uranium enriched in the isotope 233 or in the isotope 235, and any other material that is designated as special nuclear material, or (b) any material artificially enriched by any of the foregoing.

Nonnuclear Facility Hazard Classification (DOE Order 5481.1B)

***High hazard**: Have potential for on-site or off-site impacts to large numbers of people or for major impacts to the environment.*

***Moderate hazard**: Present considerable potential for on-site impacts to people or the environment, but at most only minor off-site impacts.*

***Low hazard**: Present minor on-site and negligible off-site impacts to people or the environment.*

material are called radiological facilities. Radiological facilities may be categorized under the nonnuclear facility categories as low radioactive hazard (L/RAD) or moderate radioactive hazard (M/RAD).

The number of nuclear and radiological facilities by TA is provided in Table 2.2–1. The number of nonnuclear facilities that have moderate or low chemical hazard categorization (M/CHEM or L/CHEM), and those with energetic source hazard (L/ENS) are also listed. LANL has no high-hazard nonnuclear facilities.

2.2.1 Technical Areas

LANL is divided into 49 separate TAs (Figure 2.2.1–1) (the TAs are not numbered sequentially). These TAs compose the basic geographic configuration of LANL. TA–3 is located on South Mesa and is the main, or core, TA where approximately half of the personnel are located. TA–3 serves as the central technical, administrative, and physical support facility for LANL. One TA is remote from the main area; the Fenton Hill site, TA–57, is located approximately 20 miles (32 kilometers) west of LANL.

A brief description of each TA operated by LANL is presented in Table 2.2.1–1. Additional information is provided in the *Description of Technical Areas and Facilities at LANL* (LANL 1998c).

2.2.2 SWEIS Key Facilities

To facilitate a logical and comprehensive evaluation of the potential environmental impacts of the four alternatives for future operations of LANL, the SWEIS focuses on those facilities or operations that meet the following screening criteria. The facilities identified as key for the purposes of the SWEIS are those that house activities that are critical to meeting assignments given to LANL, and:

- House operations that have potential to cause significant environmental impacts, or
- Are of most interest or concern to the public based on scoping comments received, or
- Would be the most subject to change due to recent programmatic decisions

To identify the SWEIS key facilities, all LANL structures were evaluated. Of the over 2,000 numerically identified structures within the 43-square-mile (111-square-kilometer) area of LANL, most are used for offices, storage, or support functions. Buildings or facilities considered to have minimal environmental impact, such as office buildings, transportables, trailers, guard houses, and passageways were eliminated from detailed consideration as key facilities. DOE thus eliminated over 1,900 structures from identification as key facilities for the SWEIS. The remaining facilities or operations were evaluated based on operational emphasis, facility operations and capabilities, and physical location. Individual facilities or groups of facilities that are closely related were then evaluated against the criteria listed above.

Table 2.2.2–1 identifies the 15 key facilities. The locations of the key facilities are shown in Figure 2.2.2–1. Taken together, the key

TABLE 2.2–1.—*Number of Nuclear and Moderate/Low Hazard Facilities at LANL by Technical Area*[a]

TECHNICAL AREA	NUCLEAR FACILITIES		NONNUCLEAR FACILITIES				
	CATEGORY 2	CATEGORY 3	M/RAD	M/CHEM	L/RAD	L/ENS	L/CHEM
TA–0				4			
TA–2					4		
TA–3	2	4		1	4	1	8
TA–8	4					5	
TA–9						32	2
TA–11						4	
TA–14						7	
TA–15					4[b]	11	
TA–16	3			1		61	3
TA–18	4				5		
TA–21	2	1		2	4		2
TA–22						25	1
TA–28						5	
TA–33		1				3	
TA–35[c]		2		1	2	8	
TA–36					1	11	
TA–37						24	
TA–39					2	14	
TA–40						22	
TA–41			4		1		7
TA–43						1	2
TA–46				1	2	9	1
TA–48		1					
TA–49						3	
TA–50	2				1		
TA–53		1			21	5	
TA–54	19			1	1		17
TA–55	2[d]				1	7	2
TA–72				1		2	
TA–73				1			

M/ = moderate hazard, L/ = low hazard, RAD = radiological, ENS = energetic source, and CHEM = chemical.

[a] TAs without nuclear or moderate/low hazard facilities are not shown. LANL does not have any Category 1 nuclear facilities.

[b] Includes a facility not yet operational.

[c] In addition, TA–35 has one facility that is a low hazard environmental source facility, TA–35–85 (LANL 1998c), due to its mercury inventory.

[d] The Nuclear Materials Storage Facility is included, although it is not yet operational (discussed in section 2.2.2.1).

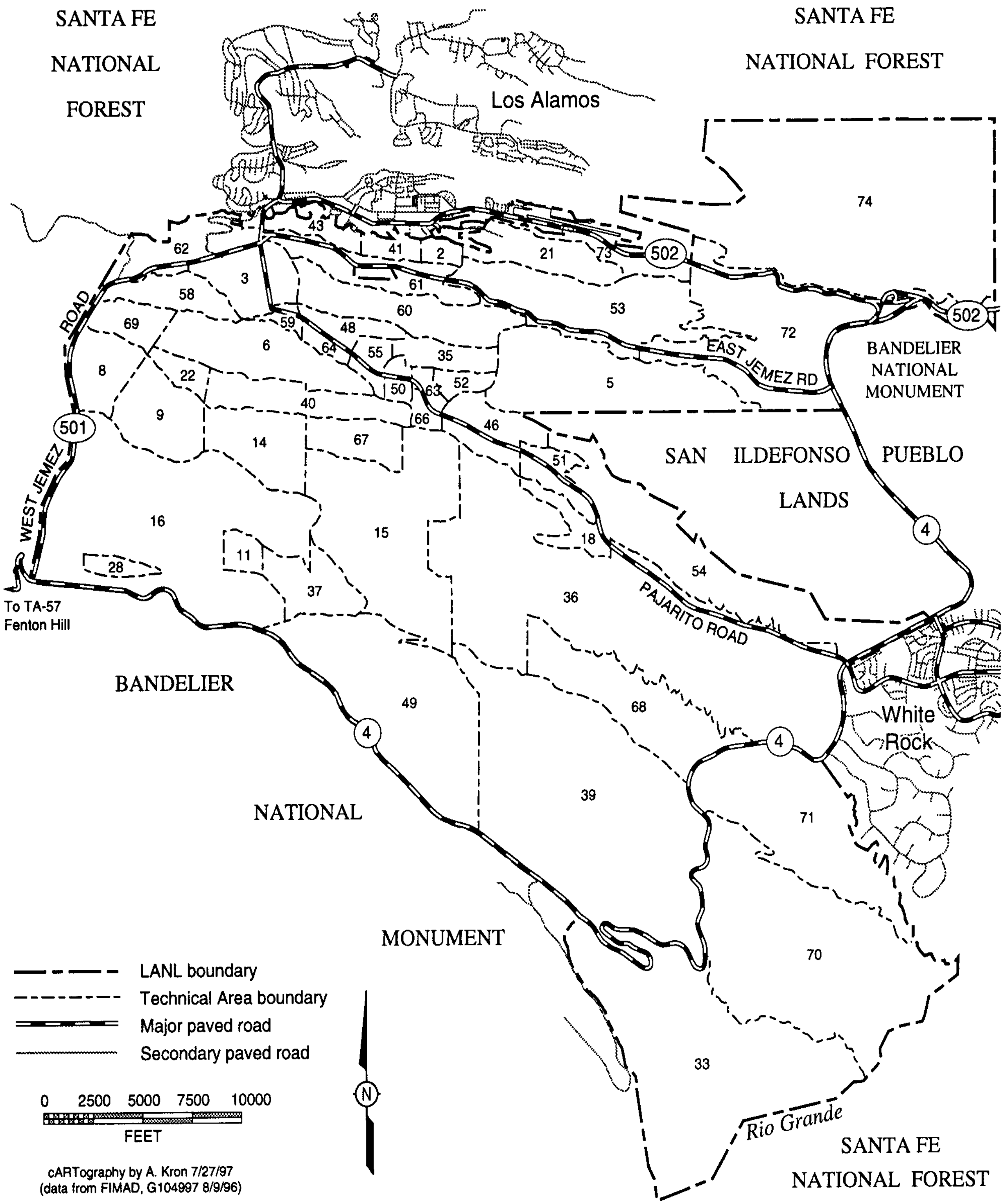


FIGURE 2.2.1–1.—*Technical Areas of Los Alamos National Laboratory.*

TABLE 2.2.1–1.—*Overview of Technical Areas and Their Associated Activities*

TECHNICAL AREA[a]	ACTIVITIES
TA–0	LANL has about 180,000 square feet (16,722 square meters) of leased space for training, support, architectural engineering design, and unclassified research and development in the Los Alamos townsite and White Rock. The Community Reading Room and the Bradbury Science Museum are also located in the Los Alamos townsite.
TA–2 (Omega Site)	Omega West Reactor, an 8-MW nuclear research reactor, is located here. It was placed in a safe shutdown condition in 1993. It is currently being removed from the nuclear facilities list and will be transferred into the decontamination and decommissioning (D&D) program possibly during 1998. All fuel has been removed from this reactor.
TA–3 (Core Area)	The Administration Complex contains the Director's office, administrative offices, and support facilities. Laboratories for several divisions are in the main TA. TA–3 contains major facilities such as the CMR Building, the Sigma Complex, the Main Shops, and the Materials Science Laboratory (MSL). Other buildings house central computing facilities, chemistry and materials science laboratories, Earth and space science laboratories, physics laboratories, technical shops, cryogenics laboratories, the main cafeteria, and the Study Center. TA–3 contains about 50 percent of LANL's employees and floor space.
TA–5 (Beta Site)	This site contains some physical support facilities such as an electrical substation, test wells, and environmental monitoring and buffer areas.
TA–6 (Two-Mile Mesa Site)	This site is mostly undeveloped and contains gas cylinder staging and vacant buildings pending decommissioning.
TA–8 (GT-Site [or Anchor Site West])	This is a dynamic testing site operated as a service facility for LANL. It maintains capability in all modern nondestructive testing techniques for ensuring quality of material, ranging from test weapons components to high-pressure dies and molds. Principal tools include radiographic techniques (x-ray machines with potentials up to 1 MeV and a 24-MeV betatron), radioisotope techniques, ultrasonic and penetrant testing, and electromagnetic test methods.
TA–9 (Anchor Site East)	At this site, fabrication feasibility and physical properties of explosives are explored. New organic compounds are investigated for possible use as explosives. Storage and stability problems are also studied.
TA–11 (K-Site)	These facilities are used for testing explosives components and systems, including vibration testing and drop testing, under a variety of extreme physical environments. The facilities are arranged so that testing may be controlled and observed remotely and so that devices containing explosives or radioactive materials, as well as those containing nonhazardous materials, may be tested.
TA–14 (Q-Site)	This dynamic testing site is used for running various tests on relatively small explosive charges for fragment impact tests, explosives sensitivities, and thermal responses.
TA–15 (R-Site)	This site houses the Pulsed High-Energy Radiation Machine Emitting X-Rays (PHERMEX) Facility, a multiple-cavity electron accelerator capable of producing a very large flux of x-rays for dynamic experiments and hydrodynamic testing. It also is the site for the Dual Axis Radiographic Hydrodynamic Test (DARHT) Facility (now under construction), whose major feature will be its intense high-resolution, dual-machine radiographic capability. This site is also used for the investigation of weapons functioning and systems behavior in nonnuclear tests, principally through electronic recordings.
TA–16 (S-Site)	Investigations at this site include development, engineering design, prototype manufacture, and environmental testing of nuclear weapons components and subsystems. It is the site of the Weapons Engineering Tritium Facility (WETF) that focuses on research and applications using tritium. Development and testing of high explosives, plastics, and adhesives, and research on process development for manufacture of items using these and other materials are accomplished in extensive facilities.

TABLE 2.2.1–1.—*Overview of Technical Areas and Their Associated Activities*-Continued

TECHNICAL AREA[a]	ACTIVITIES
TA–18 (Pajarito Laboratory Site)	This is a nuclear facility that studies both static and dynamic behavior of multiplying assemblies of nuclear materials. SNMs are used to support a wide variety of activities for stockpile management, stockpile stewardship, emergency response, nonproliferation, safeguards, etc. In addition, this facility provides the capability to perform hands-on training and experiments with SNM in various configurations below critical.
TA–21 (DP-Site)	This site has two primary research areas: DP West and DP East. DP West has been in the D&D Program since 1992, and about half of the facility has been demolished. DP West continues to provide office space for ongoing functions. Some activities conducted at DP West, primarily in inorganic and biochemistry, are being relocated during 1997 and 1998, and the remainder of the site scheduled for D&D in future years. DP East is a tritium research site and includes the Tritium Science and Fabrication Facility (TSFF) and Tritium Systems Test Assembly (TSTA).
TA–22 (TD-Site)	This site is used in the development of special detonators to initiate high-explosives systems. Fundamental and applied research in support of this activity includes investigating phenomena associated with initiating high explosives and research in rapid shock-induced reactions.
TA–28 (Magazine Area A)	This is an explosives storage area.
TA–33 (HP-Site)	The old, High-Pressure Tritium Laboratory Facility is being decommissioned. Tritium operations at this site were suspended in 1990, and the tritium inventory and operations were moved to WETF at TA–16. The National Radio Astronomy Observatory's Very Large Baseline Array Telescope is also located at this site.
TA–35 (Ten Site)	Activities include nuclear safeguards research and development that are concerned with techniques for nondestructive detection, and identification and analysis of fissionable isotopes. Research is also done on reactor safety, laser fusion, optical sciences, pulsed-power systems, high-energy density physics, metallurgy, ceramic technology, and chemical plating.
TA–36 (Kappa-Site)	This TA has four active firing sites that support explosives testing. Nonnuclear ordnance tests are conducted here, including tests of armor and armor-defeating mechanisms, as well as tests of shockwave effects on explosives and propellants. Phenomena of explosives, such as detonation velocity, are investigated at this dynamic testing site.
TA–37 (Magazine Area C)	This is an explosives storage area.
TA–39 (Ancho Canyon Site)	The behavior of nonnuclear weapons is studied here, primarily by photographic techniques. Investigations are also made into various phenomenological aspects of explosives, interactions of explosives, explosions involving other materials, shock wave physics, equation-of-state measurements, and pulsed-power systems design.
TA–40 (DF-Site)	This site is used in the development of special detonators to initiate high-explosives systems. Fundamental and applied research in support of this activity includes investigating phenomena associated with the physics of explosives.
TA–41 (W-Site)	Personnel at this site engage primarily in engineering design and development of nuclear components, including fabrication and evaluation of test materials for weapons.
TA–43 (Health Research Laboratory)	This site is adjacent to the Los Alamos Medical Center. Research performed at this site includes structural, molecular, and cellular radiobiology; biophysics; mammalian radiobiology; mammalian metabolism; biochemistry; and genetics. The DOE Los Alamos Area Office is also located within TA–43.
TA–46 (WA-Site)	Activities include applied photochemistry research such as the development of technology for laser isotope separation and laser enhancement of chemical processes. A new facility completed during 1996 houses research in inorganic and materials chemistry. The Sanitary Wastewater Systems Consolidation Project is located at the east end of this site.
TA–48 (Radiochemistry Site)	Research and development activities at this site include a wide range of chemical processes such as nuclear and radiochemistry, geochemistry, biochemistry, actinide chemistry, and separations chemistry. Hot cells are used to produce medical radioisotopes.

TABLE 2.2.1–1.—*Overview of Technical Areas and Their Associated Activities*-Continued

TECHNICAL AREA[a]	ACTIVITIES
TA–49 (Frijoles Mesa Site)	This site is currently restricted to carefully selected functions because of its location near Bandelier National Monument and past use in high-explosives and radioactive materials experiments. The Hazardous Devices Team Training Facility and the Antenna Test Range are located here. A helicopter pad used for wildfire response and storage for interagency wildfire response supplies are also located here.
TA–50 (Waste Management Site)	Activities include management of the industrial liquid and radioactive liquid waste received from various TAs. Activities also include development of improved methods for solid waste treatment and containment of radionuclides removed by treatment.
TA–51 (Environmental Research Site)	Research and experimental studies on the long-term impact of radioactive waste on the environment and types of waste storage and coverings are studied at this site.
TA–52 (Reactor Development Site)	A wide variety of theoretical and computational activities related to nuclear reactor performance and safety are done at this site.
TA–53 (Los Alamos Neutron Science Center)	This site includes the Los Alamos Neutron Science Center (LANSCE), the LANSCE linear proton accelerator, the Manuel Lujan Jr. Neutron Scattering Center, and a medical isotope production facility. Also located at TA–53 are the Accelerator Production of Tritium Project Office, including the Low-Energy Demonstration Accelerator (LEDA), and research and development activities in accelerator technology and high-power microwaves.
TA–54 (Waste Disposal Site)	Activities consist of radioactive and hazardous solid waste management including storage, treatment, and disposal operations.
TA–55 (Plutonium Facility Site)	This facility provides research and applications in chemical and metallurgical processes for recovering, purifying, and converting plutonium and other actinides into many compounds and forms, as well as research into material properties and fabrication of parts for research and stockpile applications. Additional activities include the means to safely and securely ship, receive, handle, and store nuclear materials, as well as manage the wastes and residues produced by TA–55 operations. The Nuclear Materials Storage Facility (NMSF) is located at this TA.
TA–57 (Fenton Hill Site)	This site is located about 20 miles (32 kilometers) west of Los Alamos on the southern edge of the Valles Caldera in the Jemez Mountains, and was the location of LANL's now decommissioned Hot Dry Rock geothermal project. The site is used for the testing and development of downhole well-logging instruments and other technologies of interest to the energy industry. Because of the high elevation and remoteness of Fenton Hill, a gamma ray observatory is located at the site, and other astrophysics experiments are planned.
TA–58 (Two-Mile North Site)	This site is reserved for multi-use experimental sciences requiring close functional ties to activities currently located at TA–3.
TA–59 (Occupational Health Site)	Occupational health and safety and environmental activities are conducted at this site. Environmental, safety and health offices, and emergency management facilities are also located here.
TA–60 (Sigma Mesa)	This area contains physical support and infrastructure facilities, including the Test Fabrication Facility and Rack Assembly and the Alignment Complex.
TA–61 (East Jemez Road)	This site is used for physical support and infrastructure facilities, including the Los Alamos County sanitary landfill.
TA–62 (Northwest Site)	This site is reserved for multi-use experimental science, public and corporate interface, and environmental research and buffer zones.
TA–63 (Pajarito Service Area)	This site is a major growth area with environmental and waste management functions and facilities. This area contains physical support facilities operated by Johnson Controls, Inc.
TA–64 (Central Guard Site)	This is the site of the Central Guard Facility and headquarters for the Hazardous Materials Response Team.
TA–66 (Central Technical Support Site)	This site is used for industrial partnership activities.
TA–67 (Pajarito Mesa Site)	This area is a buffer zone, designated as a TA in 1989. No operations or facilities are currently located here.

TABLE 2.2.1–1.—*Overview of Technical Areas and Their Associated Activities*-Continued

TECHNICAL AREA[a]	ACTIVITIES
TA–68 (Water Canyon Site)	This is a dynamic testing area.
TA–69 (Anchor North Site)	This undeveloped TA serves as an environmental buffer for the dynamic testing area.
TA–70 (Rio Grande Site)	This undeveloped TA serves as an environmental buffer for the high-explosives test area.
TA–71 (Southeast Site)	This undeveloped TA serves as an environmental buffer for the high-explosives test area.
TA–72 (East Entry Site)	This is the site of the Protective Forces Training Facility (Live Firing Range).
TA–73 (Airport Site)	This area is the Los Alamos Airport. DOE owns the airport, and the County of Los Alamos manages, operates, and maintains it under a leasing arrangement with DOE. Use of the airport by private individuals is permitted with special restrictions.
TA–74 (Otowi Tract)	This large area, bordering the Pueblo of San Ildefonso on the east, is isolated from most of LANL. This site contains LANL water wells and future well fields.

[a] The concept of technical areas (TAs) was implemented during the first 5 years of LANL's existence; however, the early TA designations did not cover all land within the LANL boundary and, in the early 1980's, LANL's TA numbering system was revamped to provide complete coverage. Because all TAs received new numbers, a correlation between the historic system and the current system does not exist. In addition, in the current system, some numbers were reserved for future TAs. Sites that have been closed or abandoned were incorporated into adjacent TAs.

MW = Megawatt, MeV = million electron volts

TABLE 2.2.2–1.—*Identification of Key Facilities for Analysis of LANL Operations*

KEY FACILITY IDENTIFICATION	TECHNICAL AREA
Plutonium Facility Complex	TA–55
Tritium Facilities	TA–16 & TA–21
CMR Building	TA–3
Pajarito Site (including the Los Alamos Critical Experiments Facility [LACEF])	TA–18
Sigma Complex	TA–3
MSL	TA–3
Target Fabrication Facility	TA–35
Machine Shops	TA–3
High Explosive Processing Facilities	TA–8, TA–9, TA–11, TA–16, TA–28 & TA–37
High Explosive Testing Facilities	TA–14, TA–15, TA–36, TA–39, & TA–40
LANSCE	TA–53
Health Research Laboratory (HRL)	TA–43
Radiochemistry Laboratory	TA–48
Waste Management Operations: Radioactive Liquid Waste Treatment Facility	TA–50 & 21
Waste Management Operations: Solid Radioactive and Chemical Waste Facilities	TA–50 & TA–54

facilities represent the great majority of exposure risks associated with continuing operations at LANL because these facilities represent:

- Over 99 percent of all radiation doses to LANL personnel
- Over 99 percent of all radiation doses to the public
- Over 90 percent of all radioactive liquid waste generated
- Over 90 percent of the radioactive solid waste generated
- Approximately 30 percent of chemical waste (both RCRA regulated and industrial) generated; the remaining 70 percent of chemical wastes are generated in very small volumes throughout the balance of the laboratory in individual bench-scale and laboratory experiments and in analytical chemistry support activities

Practically all of the facilities that are nuclear facilities or moderate hazard nonnuclear facilities are included as key facilities in the SWEIS. The only moderate hazard nonnuclear facilities not included are water treatment stations using chlorine (these nonnuclear facilities are considered in the accident analysis as discussed in section 5.1.11) and two nonoperating nuclear facilities, Omega West Reactor (fuel has been removed) and a tritium facility at TA–33, which have been stabilized, contain only minimal inventories and are awaiting decontamination and decommissioning (section 2.2.3).

LANL actions anticipated over the next 10 years within the key facilities are identified for each alternative, as described in chapter 3 and analyzed in chapter 5.

2.2.2.1 *Plutonium Facility Complex (TA–55)*

The facilities at TA–55 are located on a 40-acre (16-hectare) site about 1 mile (1.6 kilometers) southeast of TA–3 (Figure 2.2.2.1–1). TA–55 is one of the larger TAs at LANL. The main complex has five connected buildings: Administration Building (55–1), Support Office Building (55–2), Support Building (55–3), Plutonium Facility (55–4), and Warehouse (55–5) (listed in Table 2.2.2.1–1). The Nuclear Materials Storage Facility (NMSF, 55–41) is separate from the main complex but shares an underground transfer tunnel with 55–4. (Note that these buildings are sometimes referred to as Plutonium Facility [PF]–1, PF–2, PF–3, PF–4,

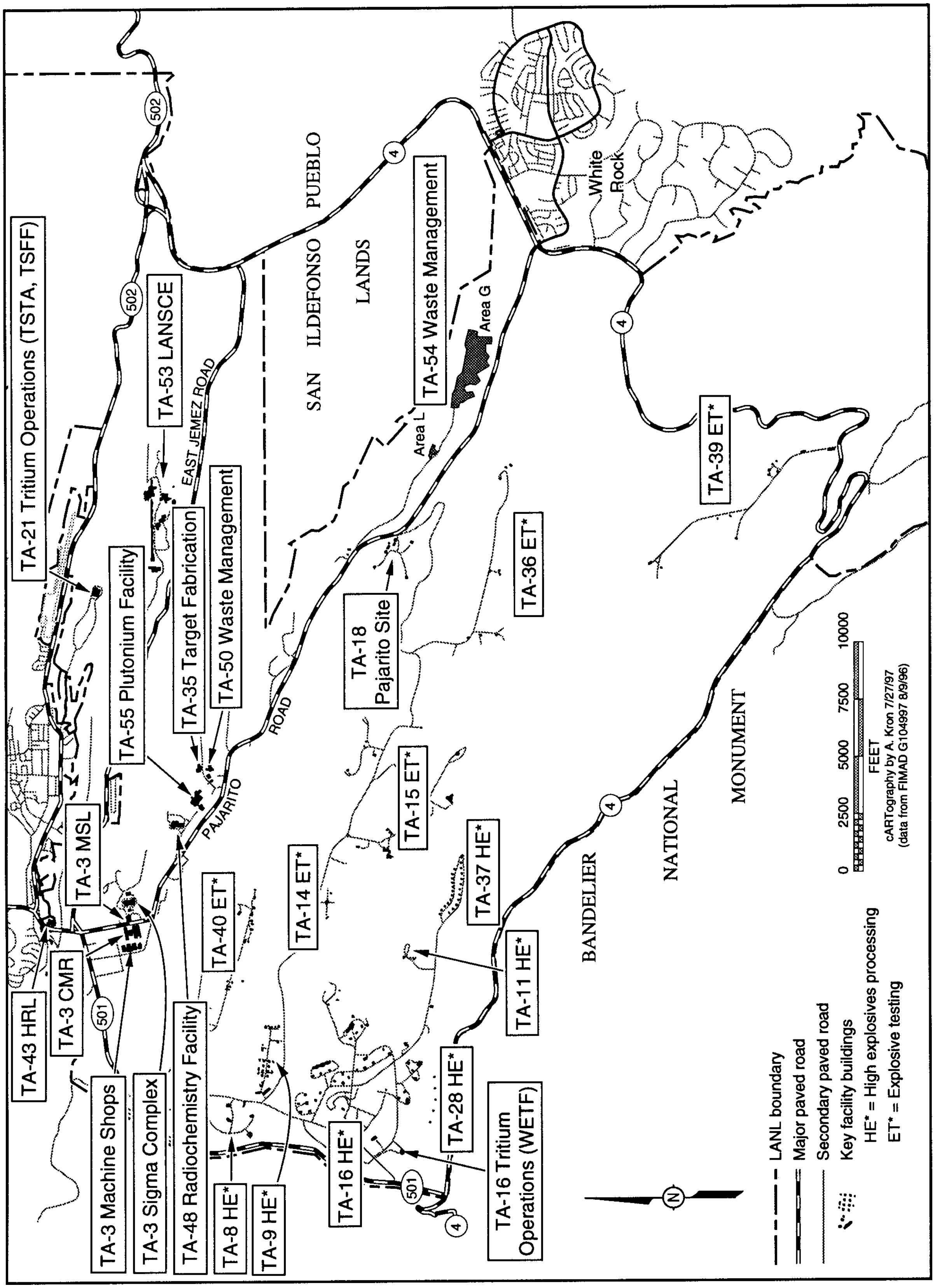


FIGURE 2.2.2–1.—*Key Facility Locations Within LANL.*

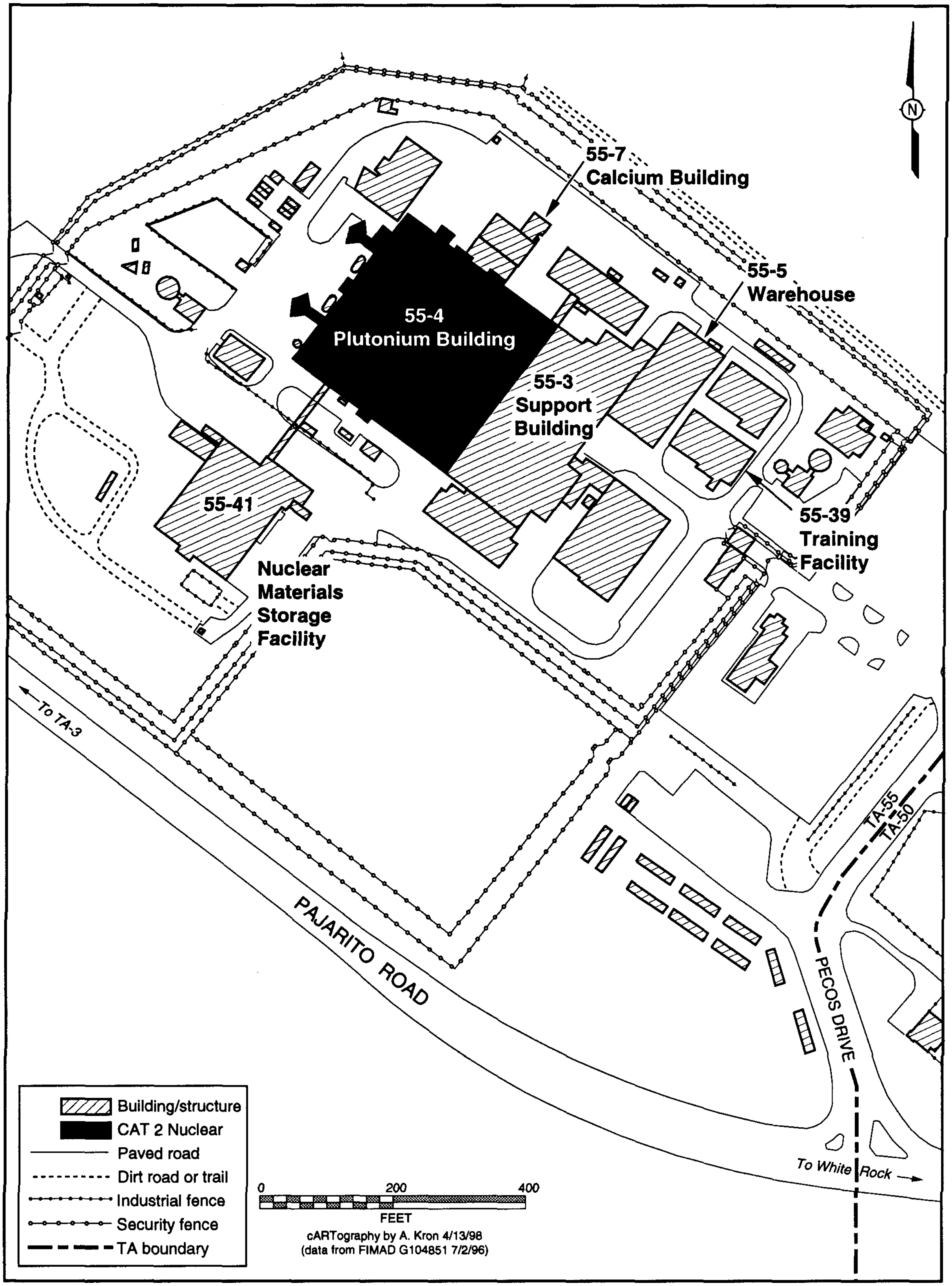


FIGURE 2.2.2.1–1.—*TA–55 Plutonium Facility Complex.*

TABLE 2.2.2.1–1.—*Principal Buildings and Structures of the Plutonium Facility Complex (TA–55)*

TECHNICAL AREA	PRINCIPAL BUILDINGS AND STRUCTURES
TA–55	Offices, Laboratories: 55–1, 2, 3, 20, 39, 107, 110, 114, 124, 135, 136, 137, 138, 139, 144, 145, 177, 264
	Plutonium Building: 55–4
	Warehouse: 55–5
	Calcium Building: 55–7
	Materials Control and Accountability Support Building: 55–28
	Training Center: 55–39
	Nuclear Materials Storage Facility: 55–41
	Process Support Building: 55–42
	Assessment Buildings: 55–43, 142
	Generator Building: 55–47
	TRU Drum Storage Building: 55–185

PF–5, and PF–41.) After renovations are completed, the NMSF will provide intermediate-term storage for up to 7.3 tons (6.6 metric tons) of LANL's SNM inventory, mainly plutonium. Various support, storage, security, and training structures are located throughout the main complex. The cornerstone research and development facility at TA–55 is the Plutonium Facility (55–4). Plutonium is processed at this facility, which is a two-story laboratory of approximately 151,000 square feet (14,028 square meters). The Plutonium Facility complex has the capability to process and perform research with the range of actinide materials (actinides are a series of chemically similar, mostly synthetic, radioactive elements with atomic numbering ranging from 89 [actinium] through 103 [lawrencium] and including thorium [90], uranium [92], plutonium [94], and americium [95]). The discussion focuses on plutonium because most of the work in this facility is done with plutonium; work done with other actinides is similar in nature.

Description of Facilities

Building TA–55–4 is categorized as a Hazard Category 2 nuclear facility (see the text box on Nuclear Facilities Hazards Classification in section 2.2), and was built to comply with seismic standards for Hazard Category 1 buildings. The ventilation system in the facility has four zones. The overall design concept for the Plutonium Facility separates the building into two halves, separated by a fire wall and other fire safety features. TA–55–4 was designed to correct the deficiencies that led to the 1969 Rocky Flats fire. An overview of the 1969 plutonium fire at the Rocky Flats site and a comparison of the design and operational differences between the Rocky Flats Plant and TA–55–4 are presented in appendix G, section G.4.1.2. Two facilities (TA–55–3 and TA–55–5) are designated as low hazard chemical facilities, and one facility (TA–55–7) has a low hazard energetic source classification. The other facilities at TA–55 are designated as no hazard facilities. (These are administrative, technical, and general storage buildings, passageways, and pump stations.)

The NMSF (TA–55–41) is located to the west of the main Plutonium Facility complex (shown in Figure 2.2.2.1–1) but shares an underground transfer tunnel with that facility. The building's main vault area is a two-level design, 36 feet (11 meters) tall by 55 feet (17 meters) wide by 150 feet (46 meters) long, of reinforced concrete. The lower level is below grade (i.e., it is below the surface of the ground). The office, mechanical, and receiving area is a single-story concrete structure 85 feet (26 meters) wide by 150 feet (46 meters) long. The ventilation stack rises 17 feet (5 meters) above the roof line. The NMSF was designed to be an intermediate-duration (up to 50 years) storage facility for the LANL inventory of plutonium, uranium, and other actinides and to be the central shipping and receiving point for nuclear materials at TA–55. The design capacity is 7.3 tons (6.6 metric tons) of SNM in metal and oxide forms, which will make the facility Hazard

Category 2, once it is authorized to operate. Although construction was completed in 1987, the facility has never been operated because of major design and construction deficiencies.

Design for renovation of this facility is currently underway. The actual renovations are scheduled to begin in 2000, but are not yet funded. Renovations are scheduled for completion in 2005, and the facility is expected to be operational in 2005. The NMSF renovation project includes:

- Installing a drywell storage array system
- Reworking the air flow system to allow the storage array to be passively cooled by convection of ambient air
- Constructing a new mechanical penthouse for heating, ventilation, and air conditioning equipment
- Reconfiguring the administrative support area, security system, decontamination stations, and mechanical room
- Adding reinforcement to the structure
- Reconstructing the Material Access Area (MAA)

The facility is planned to operate as a passive air-cooled storage structure with air intake at the lower level and exhaust through the stack. A taller stack (as compared to the existing one) might be required for the passive convective cooling system to operate effectively. Alternatively, an active cooling system may be considered appropriate.

A material accountability and assay area may be established in the NMSF as support for the storage, shipping, and receiving functions. Nondestructive assays may be performed at the NMSF on sealed containers as they are received and before they are shipped, to verify identity and quantity of package contents. The primary containers of nuclear materials will not be opened within NMSF.

Because materials in the vault area are stored in sealed containers, the vault area will not be high HEPA filtered; the air in the receiving area, material assay area, and change rooms will exhaust through HEPA filters.

Description of Capabilities

The capabilities at TA–55 include many operations by which actinides (primarily plutonium):

- Are used in research on and characterization of physical and chemical properties and metallurgy of these materials and alloys.
- In weapons component form are taken apart or disassembled into metal scrap to be recovered.
- In metal scrap form are recovered (or reprocessed) into oxide and metal forms (stabilized) that may be stored or redirected into fabrication, research and development processes, or may be dispositioned.
- In residue form are dissolved and chemically processed to recover the plutonium as metal, oxalate or oxide, for further processing.
- In metallic form are manufactured into components or parts useful in research or weapons applications.
- In metal or oxide form are processed (or fabricated) into materials useful as sources of heat and nuclear power (fuel pellets and rods).
- Can be converted from metal to oxide and visa versa.
- In any of the above forms serve as feedstock for various research and development activities.
- Measurement technologies are developed for material control, nonproliferation, international inspection applications.

Terminology Related to Pit Production

Fabrication/Manufacturing—*For purposes of the SWEIS, these terms are synonymous. LANL has an existing capability to fabricate or manufacture plutonium parts. That is, the equipment, knowledge, supporting infrastructure, and administrative procedures and controls exist at LANL to create plutonium metallic shapes to precise specifications. This capability is currently used in support of existing missions for research and development and will be used to rebuild some of the pits destroyed in stockpile surveillance activities.*

Production—*For the purposes of the SWEIS, this term is used to describe the fabrication/ manufacturing of a relatively large quantity of parts (as compared to the research and development and prototype capability). In the ROD for the SSM PEIS, DOE decided to meet its need for a pit production capability by enhancing its existing fabrication/ manufacturing capability at LANL. This enhancement consists of changes to optimize material flows, remove "choke points" that limit the quantity that can be made, improve efficiency, and replace or upgrade equipment to improve process yield and reliability.*

The processing capabilities can be divided into manufacturing steps and reprocessing or recovery steps. Processes can also be considered as "wet" or "dry" in terms of the relative volumes of radioactive liquid wastes produced. Chemical reprocessing operations are generally considered wet because they generate radioactive liquid wastes from precipitation, wash, and ion exchange elution steps. The nitrate and chloride aqueous processes produce acid and caustic streams containing most of the radioactive content in the aqueous waste from TA–55.

Manufacturing processes are considered to be dry because they involve metal forming and oxide pressing operations that do not produce aqueous wastes containing dissolved actinides. Similarly, pyrochemical processing and other recovery processes that utilize heat to effect separations (e.g., tritium separations) are considered dry processes.

Division into wet and dry processes is complicated because 95 percent by volume of the radioactive liquid waste effluent from TA–55 is industrial wastewater, water used in various cooling processes within the facility. All the manufacturing and pyrochemical operations and many of the reprocessing operations require water for cooling. This includes water used in cooling processing equipment (cooling jackets on ion exchange columns and metal melting furnaces) and the discharge from the heating, ventilation, and air conditioning system that serves the radioactive processing areas in TA–55–4.

The principal activities conducted at the Plutonium Facility are described below. The manner in which these activities would vary among the alternatives is described in chapter 3.

Plutonium Stabilization. Stabilization encompasses a variety of plutonium (and other actinide) recovery operations. The goal of this activity is to improve the storage condition of legacy plutonium in the LANL inventory. Some of the existing containers show signs of corrosion. Further, the stability of some of the materials can be improved through reprocessing, cleaning, high-firing (oxidizing at relatively high temperatures) oxides, and storage in improved containers. As of early 1996, the inventory included 1.2 tons (1.1 metric tons) of metallic plutonium, 0.83 tons (0.75 metric tons) of plutonium in residue forms, and 0.83 tons (0.75 metric tons) of plutonium in oxide forms. Under all of the alternatives, the plan is to reprocess 10 percent of the metal form, all of the residues, and 15 percent of the oxides to a stable oxide form. The remainder of the metal will be cleaned and remaining oxides will be high-fired. After these stabilization steps, the materials will be repackaged under inert atmosphere (an atmosphere free of materials that may initiate chemical reactions) in pressure-closure cans that are then placed in outer cans that are welded closed. These will be stored until needed to support program requirements. The processes that will be used to clean metallic plutonium, to convert metal to oxide, to reprocess the scrap material, and to high-fire oxides are parts of the regular chemical processing capability in operation at TA–55. The length of time that would be taken to complete these activities varies among the alternatives.

Manufacturing Plutonium Components. The goal of this activity is to take purified plutonium metal and use it to manufacture pits or other items for research and development or to manufacture components for the nuclear weapons stockpile. This capability includes the fabrication of samples and parts for research applications, including dynamic experiments, subcritical experiments (at the Nevada Test Site), fundamental research on plutonium at the Los Alamos Neutron Science Center (LANSCE), and has been used in the past to fabricate pits for nuclear tests. Some equipment, tools, designs, and documentation specific to pit manufacturing have been moved from the Rocky Flats Plant to LANL. Changes will be made in the manufacturing process to reduce waste production and worker exposure. In general, the processes and procedures used for this capability differ in capacity, in technology, and in safety and environmental measures as compared to those previously used at the Rocky Flats Plant. Some aspects of the manufacturing process such as welding and coating technologies are still being developed. Pure metal will be cast to a very close approximation of the final dimensions (near net shape). This will reduce the need for extensive machining and reduce the production of waste and scrap (as compared to techniques used in the past). Some final machining and polishing will be required. The plutonium items produced may be encapsulated or coated with stainless steel, beryllium, or other materials. At every step, the pieces are inspected and samples are taken for analysis. Those finished components that meet the specifications may be stored in the Plutonium Facility vault or NMSF pending shipment or research use. Those that do not meet specifications are reprocessed into plutonium metal.

Surveillance and Disassembly of Weapons Components. The goal of this activity is to conduct a series of nondestructive and destructive evaluation on pits removed from the stockpile and/or from storage, as well as for materials being considered in process development activities. These evaluations determine the effects of aging and other stresses on pits, as well as the compatibility of materials used or being considered for use in weapons. They are a part of the stockpile reliability and safety analysis and documentation programs that DOE has conducted for the nuclear weapons stockpile since pit production was initiated. The evaluation program was transferred from the Rocky Flats Plant to LANL in the early 1990's. Beginning with the intact pit, a series of tests are made to determine the changes in the materials from which the pit was constructed. Tests include leak testing, weighing, dimensional inspection and measurements, dye penetration tests, and radiography. Some of the pits evaluated at LANL are returned to storage after these nondestructive analyses (to be analyzed again at a later date). Other pits are taken apart (disassembled) for further tests, which include metallography, micro-tensile testing, and chemical analysis. The scrap remaining after these destructive tests is reprocessed. Any pit fabricated at LANL or sent to LANL could be evaluated or disassembled through these processes.

Actinide Materials Science and Processing Research and Development. Several aspects of materials research on plutonium (and other actinides) are conducted at TA–55. In general, these include metallurgical and other characterization of materials, and measurements of physical materials properties. These measurements provide data that support assessments of the safety and reliability performance of nuclear weapons, including the behavior of aging weapons components and replacement components and their suitability for certification. They also support other activities at LANL, such as characterizing samples for components, including those produced at TA–55, for experiments conducted at LANL or elsewhere, as well as measurements surveillance of stockpile components. Activities to develop new measurements for enhanced surveillance also are conducted at the facility. In addition, measurements at TA–55 study the properties of plutonium materials and samples at high strain rates using a 40-millimeter projectile launcher Impact Test Facility, apparatus such as Kolsky (split Hopkinson) Bars, and other bench-scale capabilities to measure mechanical and physical properties. These operations are usually conducted in gloveboxes and involve relatively small amounts of plutonium, as compared with other activities at TA–55.

In addition, research at TA–55 supports development and assessment of technologies for manufacturing and fabrication of components, a capability discussed previously in this section. These activities include research on welding and bonding processes and research associated with casting, machining, and other forming technology. In addition, measurements associated with fire-resistance of weapons components are conducted at TA–55.

Actinide processing (also called recovery and reprocessing) includes methods by which plutonium and other actinides can be extracted, concentrated, and converted into forms easier to store and to use in other activities. The discussion below focuses on plutonium because this accounts for most of the processing activity at TA–55, but the discussion also applies to the many other actinides used in research at LANL.

The ease with which plutonium may be recovered depends upon the form of the material:

- *Recoverable*—Metal components, ash, sand, slag, castings, combustible and noncombustible equipment, impure oxides, sweepings, organic solutions, alloys, various salts, and filter residues
- *Difficult to recover further*—Leached metal, decontaminated components, and evaporation residues
- *Practically irrecoverable*—Vitrified material and ceramic forms

The form, recoverability, and the concentration of plutonium remaining determines whether the material will be discarded as waste or treated with further reprocessing steps. Aspects of this reprocessing capability are described below.

Actinide recovery processing typically involves dissolving materials in nitric or hydrochloric acid using the physical and chemical characteristics of the actinide (e.g., using solvent extraction or ion-exchange processes) to preferentially extract it as a high purity solution. The high-purity actinide can then be removed from the solution (through precipitation and filtration) and converted to an oxide or oxalate form. Finally, the oxides and oxalates can be converted to metal using a variety of chemical processing techniques, including high temperature oxidation and electrochemical techniques. Waste solutions from these processes are pre-treated (redistilled to reclaim acid and precipitate nitrate sludges if appropriate) before being discharged as radioactive liquid waste to TA–50 (described in section 2.1.2.14).

Tritium separation is a special type of actinide processing. Tritium sorbs into many actinide materials where it is strongly held. Tritium can be removed from these materials by heating the material in an inert atmosphere. The actinide material is then cooled and removed. The dedicated glovebox line at TA–55–4 containing the furnace and associated equipment is called the Special Recovery Line.

The hydride-dehydride process is another special type of actinide processing. This process is used in the Advanced Recovery and Integrated Extraction System and may be used in other disassembly and material recovery processes. This process converts plutonium metal to plutonium hydride, which can be easily removed from other materials. The plutonium hydride can then be converted to either plutonium metal or oxide. The hydrogen used in this process is recycled. Although this process was designed for pits, other forms of metallic plutonium that are amenable to hydriding could also be reprocessed using this technique.

Actinide materials that emit alpha particles, such as plutonium or americium, have been intimately mixed with a material such as beryllium or beryllium oxide, to produce a strong and long-lasting source of neutrons, which is then sealed in stainless steel cladding. The U.S. Government provided about 20,000 of these neutron sources to universities, industry, and governmental agencies, which are licensed through the U.S. Nuclear Regulatory Commission (NRC) to utilize such materials. Most of these sources are no longer in use and, through an agreement with the NRC, they are being returned to DOE for reprocessing (using actinide recovery processes) at LANL. At present, plutonium-239/beryllium sources are being reprocessed at TA–55, but the capability could be used to reprocess americium-241/ beryllium sources as well.

In addition, this actinide reprocessing capability includes research into new recovery and decontamination techniques, research regarding the fundamental properties of actinides, analytical and nondestruction measurement of actinides (including development of new techniques), and research regarding nuclear fuels.

Fabrication of Ceramic Based Fuels. LANL develops and demonstrates ceramic based nuclear reactor fuel fabrication technologies. LANL has demonstrated the ability to produce such fuel, including prototype mixed oxide (MOX) fuel from plutonium and uranium. This demonstration involves processing of metals and oxides. Plutonium and uranium oxides are mixed together, and made into a ceramic form which is pressed into pellets. The pellets are sealed in cladding materials as a fuel rod. Fuel rods can be bundled together into fuel assemblies.

Plutonium-238 Research, Development, and Applications. Plutonium-238 has the interesting properties of being minimally fissile (making it more difficult to sustain a chain reaction) yet producing a large amount of heat through radioactive decay. This isotope is used to provide a long-term reliable source of heat that can be used directly and can be converted into electricity when assembled into radioisotopic thermoelectric generators (RTGs). The electricity produced by the RTGs has been used to operate mechanical devices, instruments, and communications on remote sensing devices such as spacecraft and to activate switches in some nuclear weapons designs. RTGs and units called milliwatt generators have been produced, tested, and reprocessed at the Plutonium Facility for many years, and RTG research and development (including design), fabrication, and testing activities continue. Plutonium-238 activities are kept separate from the other plutonium processes to avoid cross-contamination of isotopes. After the RTGs are produced, they are extensively tested for integrity, resistance to mechanical shocks, and heat generation rate.

Aqueous reprocessing of plutonium-238 material uses the same processing techniques as used for other actinides as discussed above.

Storage, Shipping, and Receiving. Under this activity, LANL stores, packages, measures (using variety of destructive and nondestructive techniques), ships, and receives nuclear materials. These activities are housed throughout TA–55–4, with storage currently in the TA–55–4 vault and projected in NMSF upon completion of the renovation project.

2.2.2.2 *Tritium Facilities (TA–16, TA–21)*

Tritium is a radioactive isotope of hydrogen. LANL tritium operations are primarily conducted at three facilities: Weapons Engineering Tritium Facility (WETF), Tritium Systems Test Assembly (TSTA) Facility, and Tritium Science and Fabrication Facility (TSFF) (see Figures 2.2.2.2–1 and 2.2.2.2–2 and Table 2.2.2.2–1). WETF is located at TA–16; TSTA and TSFF are located at TA–21. Operations involving the removal of tritium from actinide materials are conducted at LANL's TA–55 Plutonium Facility. These operations are described in section 2.2.2.1. Limited research, instrument calibration, analytical, and storage activities involving tritium are conducted at other LANL facilities; however, the primary potential environmental impacts from tritium operations at LANL reside with the three tritium facilities listed above. These facilities support several tritium-related programs at LANL and play an important role in DOE's energy research and nuclear weapons programs.

At various times, DOE has considered whether to consolidate TA–21 tritium operations and activities at the TA–16 WETF site; most recently, this was discussed as a potential project to begin in the year 2000 and be completed by the year 2006. However, any consolidation of tritium operations and activities is speculative at this time and for this reason is not included in SWEIS analyses. If such a project were proposed by DOE, additional NEPA analysis would be pursued, tiering from the SWEIS. There will continue to be movement of tritium operations and activities among the tritium operations facilities in order to optimize use of equipment and personnel and to increase programmatic efficiency.

Description of Facilities

The Weapons Engineering Tritium Facility, a Hazard Category 2 nuclear facility, is located in Building 16–205, in the southeast section of TA–16. Planning for WETF began in 1981 with construction occurring between 1982 and 1984. WETF began operation in 1989. Construction of an addition to WETF was started in 1993 and completed in 1994. Except for the mezzanine area in Building 205, WETF is a single-level structure with approximately 7,885 square feet (732 square meters) of floor area. The equipment in the building includes gas transfer and pumping systems, gloveboxes, a glovebox exhaust system, a system of monitors and alarms, and subsystems to contain any leaked tritium gas and tritiated wastewater.

Tritium-related activities occur in the contiguous tritium-handling-areas, which are served by a ventilation system that exhausts to a 60-foot (18-meter) stack. The stack, which is northeast of 16–205, is equipped with continuous air monitors that are equipped with a tritium bubbler system for determining tritiated water and gas ratios in the effluent air stream. There is no liquid discharge from Building

TABLE 2.2.2.2–1.—*Principal Buildings and Structures of the Tritium Facilities*

TECHNICAL AREA	PRINCIPAL BUILDINGS AND STRUCTURES
TA–16	Weapons Engineering Tritium Facility Processing Building: 16–205 Formerly the Weapons Components Test Facility: 16–450
TA–21	Tritium Systems Test Assembly Facility: 21–155 Tritium Science and Fabrication Facility: 21–209

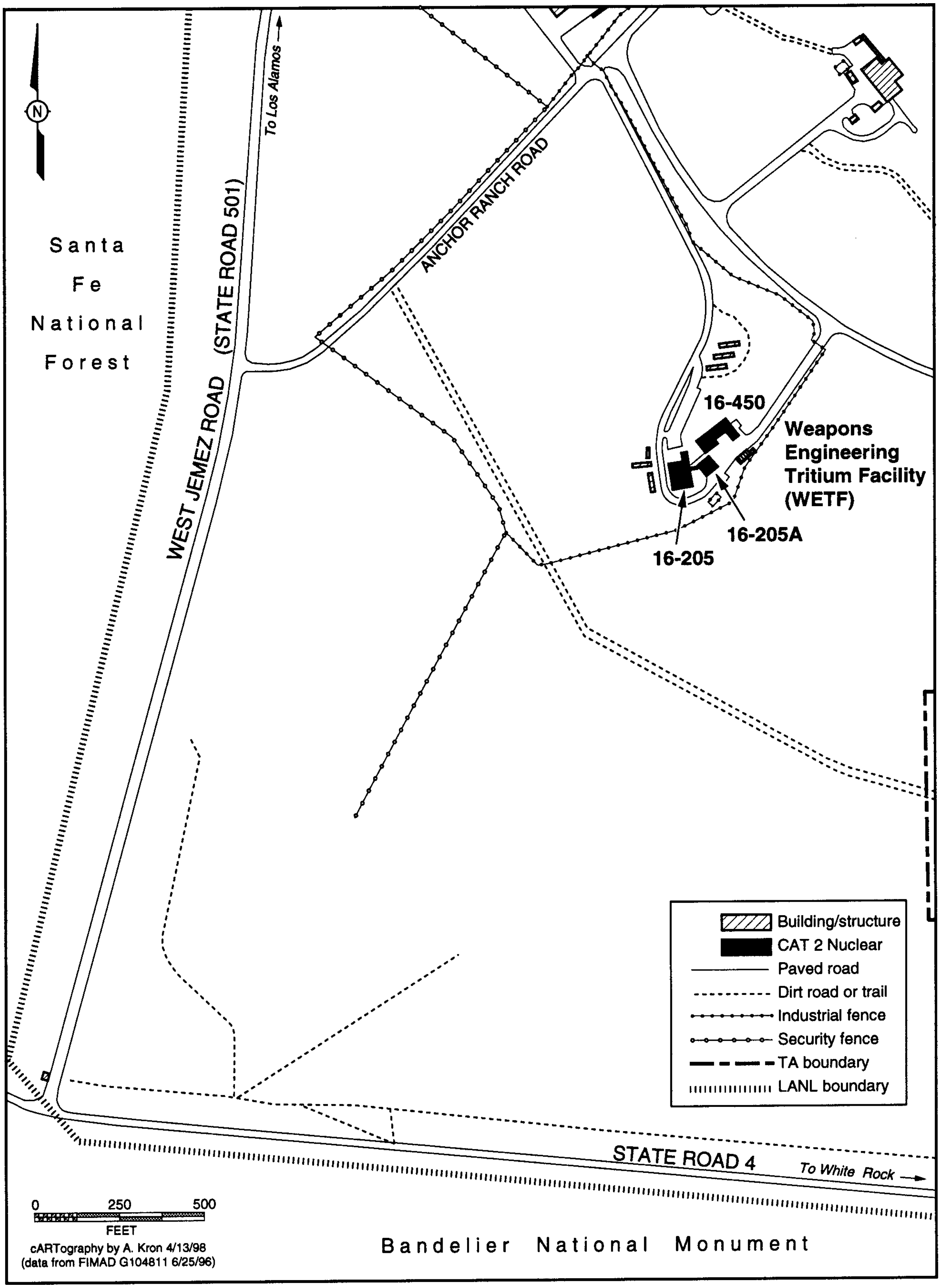


FIGURE 2.2.2.2–1.—*TA–16 Tritium Facilities (WETF).*

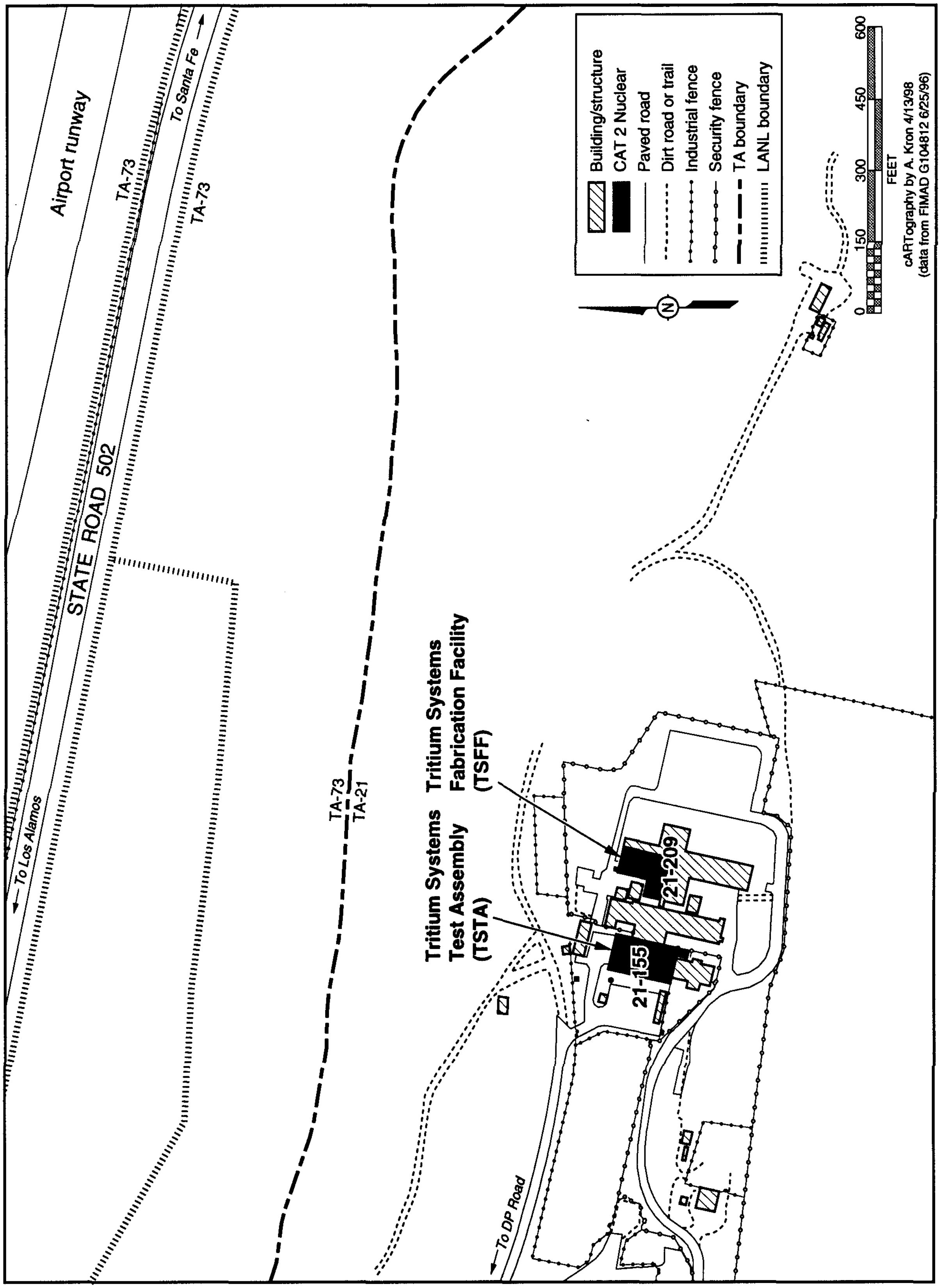


FIGURE 2.2.2.2–2.—*TA–21 Tritium Facilities (TSTA and TSFF).*

16–205 to a National Pollutant Discharge Elimination System (NPDES) outfall or directly to the Radioactive Liquid Waste Treatment Facility (RLWTF); the small amounts of contaminated mop water are collected and stored in a tank at the facility, then transported by radioactive liquid waste tanker truck to the RLWTF. The facility is functionally divided into multiple areas including an operations control area, tritium-handling areas, and support areas. Walls, roofs, and air locks separate the tritium handling areas from the rest of the facility. The support areas include offices, restrooms, and rooms that house equipment. An adjacent building (TA–16–450) will be connected to WETF, along with a new exhaust air stack, change room, and mechanical building. These changes are scheduled during the late 1990's for neutron tube target loading (NTTL) operations and related research (DOE 1995a). This building will receive a hazard category designation when it is authorized by DOE to operate.

Planning for the Tritium Systems Test Assembly facility at TA–21 began in 1977 after LANL was chosen to develop, demonstrate, and integrate technologies related to the deuterium-tritium fuel cycle for large-scale fusion reactor systems. Construction was completed and pre-tritium testing initiated in 1982. TSTA is a Hazard Category 2 nuclear facility. The TSTA facility is located at TA–21 (also called DP Site). TA–21 has two primary research areas: DP West and DP East. The DP West area is currently under decontamination and decommissioning. The TSTA facility is located at the DP East research area.

An existing building (21–155N) was modified to accommodate TSTA. The main experimental tritium area (Room 5501) has 3,700 square feet (344 square meters) of floor area. Two small laboratories are connected to the 5501 ventilation system, which also services the main experimental tritium area. In the same building, but in the area surrounding the main experimental area, there is an additional 5,993 square feet (557 square meters) of floor space that is used for the Control Room, Support Center, office area, equipment rooms, and a diesel generator. Another existing building (21–155S), which has 3,819 square feet (355 square meters) of floor area, is used for office and shop space.

In addition to the main building, there is 1,506 square feet (140 square meters) of storage space in a metal warehouse (Building 21–213) located north of the main experimental area. The east end of this building has been sectioned off and is used as a storage area for tritium contaminated equipment. There is also a portable building (Building 21–369) located on the west side of the main laboratory, which adds an additional 753 square feet (70 square meters) of office space. One stack, which is located at the northwest corner of TA–21–155N, services the TSTA tritium experimental areas.

The TSFF, a Hazard Category 2 nuclear facility, is a tritium research and development facility located in Building 209 at TA–21. The TSFF facility is located east of the TSTA facility at the DP East research area. The building was built in 1964 as a chemistry process building and modified in 1974 to accommodate tritium operations associated with nuclear weapons development and test programs. TSFF is a 3,228-square-foot (300-square-meter) block-walled area within the Building 21–209, which is a one-story building with a basement. TSFF is serviced by a process exhaust air treatment system that discharges into an exhaust ventilation system that discharges room air and treated process air to a 75-foot (23-meter) high exhaust air stack.

The radioactive materials used at WETF, TSTA, and TSFF are primarily tritium gas and metal hydride storage beds, some of which contain depleted uranium powder. Several nonradioactive toxic and hazardous substances, such as methanol and acetone, are used in small quantities to clean and maintain processing equipment at the three facilities. These are common solvents and cleaners found in most modern chemistry laboratories.

Description of Capabilities

The principal activities conducted at WETF, TSTA, and TSFF are described below. The manner in which these activities will vary among the alternatives is described in chapter 3.

High-Pressure Gas Fills and Processing (WETF). High-pressure gas fills and processing operations for research and development and nuclear weapon systems are performed at WETF at TA–16–205. High-pressure gas containers (reservoirs) are filled with tritium/deuterium gas mixtures to specified pressures in excess of 10,000 pounds per square inch. This capability is also used for filling experimental devices (e.g., small inertial confinement fusion [ICF] targets that require high pressure tritium gas).

Gas Boost System Testing and Development (WETF). Modern nuclear weapons are equipped with gas boost systems that use hydrogen isotopes including tritium. These systems and their components need ongoing maintenance, testing, development, gas replacement, and modifications to maintain safety and reliability. WETF provides highly specialized boost system function testing and experimental equipment. Also, more efficient and effective boost systems are under development and tested at WETF.

Cryogenic Separation (TSTA). To separate pure gas species from gaseous mixtures, a distillation technique is used, known as cryogenic distillation. The technique combines super cooling and high vacuum technologies for separating gaseous mixtures. This capability is used to separate gaseous tritium from other gases at TSTA. It is possible that other tritium facilities, such as WETF, at LANL could use this technique in the future.

Diffusion and Membrane Purification (WETF, TSTA, TSFF). Different gaseous species of elements move (diffuse) through membranes and other barriers at rates that depend on their molecular weight. Also, gaseous species penetrate (pass through) certain membranes differently based on their molecular size. Gas separation and purification techniques have been developed based on these two characteristics of the gaseous species. Currently, several systems exist that utilize a multi-step membrane diffusion process for effective and efficient gas separations.

All three LANL tritium facilities currently possess or plan to have the operational capability to separate and purify tritium from gaseous mixtures using diffusion and membrane purification techniques.

Metallurgical and Material Research (WETF, TSTA, TSFF). Tritium handling capabilities at the WETF, TSTA, and TSFF facilities accommodate a wide variety of metallurgical and material research activities. One example of this type of research is the investigation into the ability of various containers to remove hydrogen isotopes (including tritium) from a flowing stream of nitrogen and other inert gases. In application, this capability may be used to clean up exhaust air streams and the air in tritium containment areas without generating tritiated water, a more hazardous form of tritium.

Thin Film Loading (TSFF, WETF). The thin film loading process capability involves chemically bonding a radioactive gas, tritium, to a metallic surface. These operations are currently conducted at TSFF, but are being moved to WETF.

Tritium for the NTTL thin film loading operations are contained within a small hydride collection bed, which is refilled periodically. The hydride bed collects the tritium gas in a metal hydride form and holds it until the bed is heated to a temperature of 1,110 degrees

Fahrenheit (°F) (600 degrees Celsius [°C]). Hence, the release of tritium from the bed is a well-controlled process and the tritium cannot be released from the bed at normal temperatures. The process is conducted under vacuum conditions in an inert atmosphere.

The NTTL thin film loading system is constructed in a modular fashion. The basic modules include the loader itself, several control racks, a glovebox and hood with all internal and external attachments, a gas purifier, a chiller, and several oil-free vacuum pumps.

Gas Analysis (WETF, TSTA, TSFF). It is essential for nuclear material control and accountability, as well as experimental purposes, to have the capability to measure the composition and quantities of the gases used. Mass spectrometers are common laboratory measurement instruments used at the three LANL tritium facilities to measure the composition of gas samples. Also, Raman spectrometry is used for real time gas analysis. Other techniques such as beta scintillation counting are also used for real time and batch gas analysis. The amount of gas, including tritium, that is needed for any of these measurement techniques is small.

Calorimetry (WETF, TSTA, TSFF). Calorimetry is a well established nondestructive method used for measuring the amount of tritium in a container. This method is based on the measurement of heat flow from a container. The radioactive decay of tritium gives off heat at a rate that is directly proportional to the amount of tritium contained in gas containers. No tritium leaves the container in the performance of calorimetry measurements.

Solid Material and Container Storage (WETF, TSTA, TSFF). Safe storage of hydrogen isotopes including tritium is an important capability of all three LANL tritium facilities. Tritium in gaseous form may be stored in either specially designed dual wall containers or certified shipping containers. Tritium gas may also be safely stored in metal hydride form contained in dual wall containers. The metal hydride that forms when tritium reacts with the metallic powder in the container is a very stable compound. Tritium can be released from this compound by heating the container to several hundred degrees Celsius. Accountable quantities of tritium are stored in these ways in designated areas that have been approved for such storage.

Tritium oxide (tritiated water) can also be stored in solid form when it is adsorbed (gathered on a surface in a condensed layer) on molecular sieves. Molecular sieves are made with materials that adsorb tritiated water in the fine pores on their surface, thus forming a solid material that can be stored in containers. Tritiated water adsorbed on molecular sieves is physically stable. Tritiated water is released from the molecular sieve when the temperature is raised above the boiling point for water.

2.2.2.3 *Chemistry and Metallurgy Research Building (TA–3–29)*

The CMR Building (TA–3–29) was designed within TA–3 as an actinide chemistry and metallurgy research facility (Table 2.2.2.3–1). The main corridor with seven wings was constructed in 1952 (Figure 2.2.2.3–1). In 1960, a new wing (Wing 9) was added for activities that must be performed in hot cells (a hot cell is an enclosed area that allows for the

TABLE 2.2.2.3–1.—*Principal Buildings and Structures in the Chemical and Metallurgy Research Building*

TECHNICAL AREA	PRINCIPAL BUILDINGS AND STRUCTURES
TA–3	CMR Laboratory: 3–29
	Hot Waste Pump House: 3–154

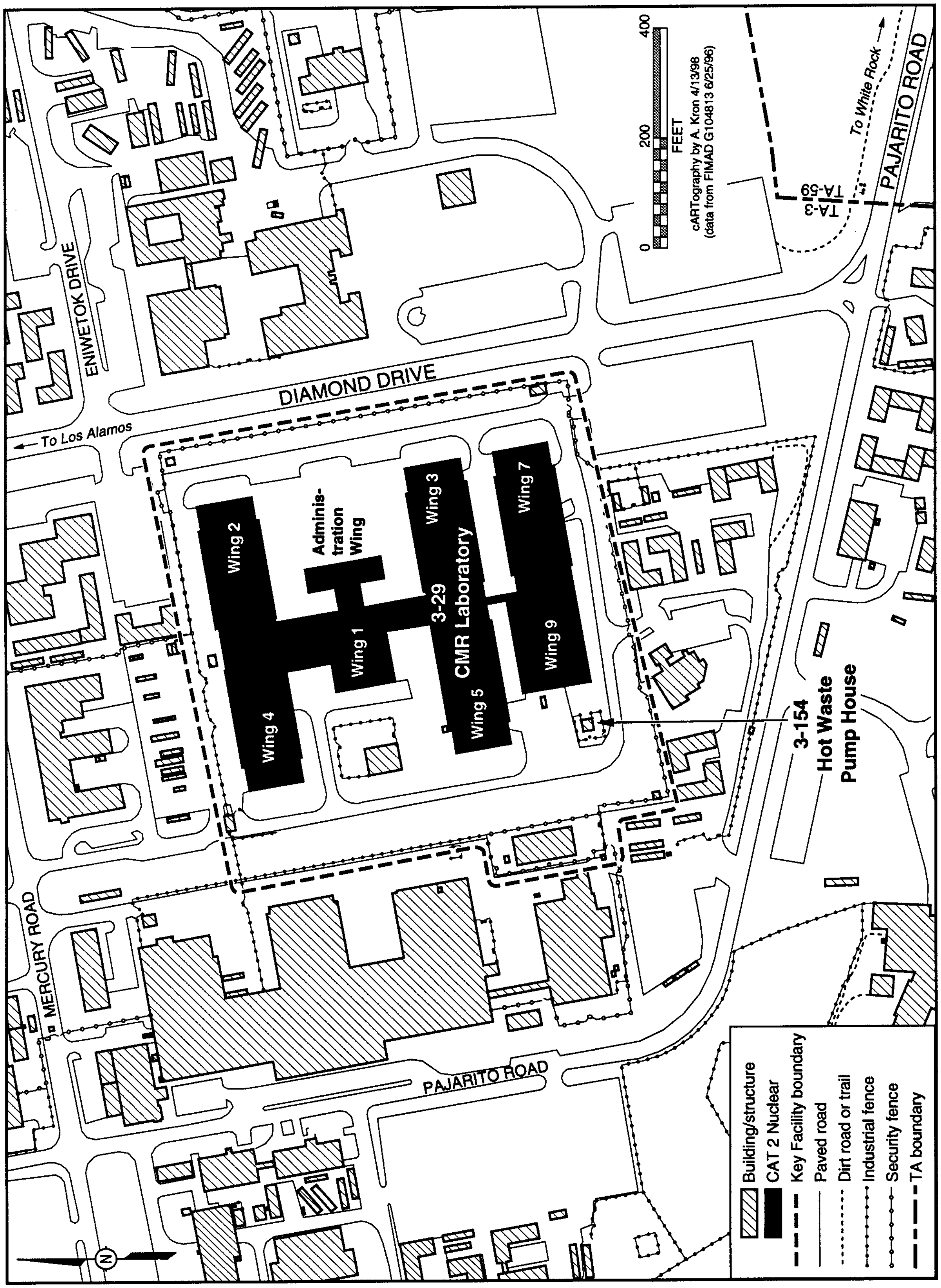


FIGURE 2.2.2.3–1.—*TA–3 Chemistry and Metallurgy Research Building.*

remote handling of highly radioactive materials). Wings 6 and 8 were never constructed. The three-story building now has eight wings connected by a spinal corridor and contains a total of 550,000 square feet (51,097 square meters) of space. It is a multiple-user facility in which specific wings are associated with different activities. It now is the only LANL facility with full capabilities for performing SNM analytical chemistry and materials science.

Description of Facility

CMR facilities include hot cells and SNM vaults. Waste treatment and pretreatment conducted within the facility is sufficient to meet waste acceptance criteria for receiving facilities, on site or off site. In addition, these facilities are used to support various activities at other LANL locations. TA–55 (described in section 2.2.2.1) provides support to CMR in the areas of materials control and accountability, waste management, and SNM storage.

The aqueous waste from radioactive activities and other non-hazardous aqueous chemical wastes from the CMR Building are discharged into a network of drains from each wing specifically designated to transport waste solutions to the RLWTF in TA–50 (described in section 2.2.2.14) for treatment and disposal. The primary sources of radioactive inorganic waste at the CMR Building include laboratory sinks, duct wash-down systems, and overflows and blowdowns from circulating chilled-water systems. The facility infrastructure is designed with air, temperature, and power systems that are operational nearly 100 percent of the time. Power to these systems is backed up with an uninterruptable power supply. The CMR Building has one NPDES outfall, which discharges seasonally into Mortandad Canyon at a rate of one gallon per minute. This outfall is slated for waste stream corrections as part of LANL's outfall reduction plan. The CMR Building was constructed in the early 1950's to the industrial building code standards in effect at that time. Over the intervening years, DOE has systematically identified and corrected some deficiencies and upgraded some systems to address changes in standards or improve safety performance. Beginning in 1970, these included:

- Ventilation system upgrades (1973 to 1974)
- Fire protection system upgrades (1978)
- Surety facility upgrades (1981, 1992)
- Asbestos repair and removal (1984 to present)
- Acid drain line replacement (1984)
- Evacuation system—public address system and alarms (1984)
- Curbing installed around equipment (1985)
- Vacuum system for continuous air monitors (1987)
- Exhaust duct cool-down system (1987)
- Heating, ventilation, and air conditioning controls (1987)
- Main storage vault (1987 to 1994)
- Alarm monitors (1988)
- PCB transformer replacement (1989)
- Removal of natural gas service from the building (1990)
- Stack emissions monitoring system (1991)
- Air sampling probes (1991)
- SNM waste assay facility (1991)

However, these upgrades have not kept up with the aging of the building or increasingly stringent safety standards. A more comprehensive series of upgrades was identified and authorized by DOE addressing specific safety, reliability, consolidation, and safeguards issues. These were prioritized, with the highest priority being assigned to equipment replacements and activities essential to maintain the minimum safe operating conditions for an interim period of 5 to 10 years, while more comprehensive upgrades were developed. These upgrades were identified by DOE as routine maintenance work, having no significant potential for environmental consequences and not intended to prolong the useful life of the facility. These "Phase I" upgrades were categorically excluded by DOE from the need for further NEPA analysis. The proposed work and the status of completion as of March 1998 includes:

- Augmenting and replacing continuous air monitors in building wings (95 percent complete)
- Replacing some heating, ventilation, and air conditioning blowers (95 percent complete)
- Upgrading basic wing electrical systems (80 percent complete)
- Upgrading power distribution system (55 percent complete)
- Replacing the stack monitoring systems (75 percent complete)
- Installing an uninterruptable power supply for the stack monitoring systems in the laboratory wings (90 percent complete)
- Making limited (interim) improvements to the duct washdown system (89 percent complete)
- Improvements to acid vents/drains (41 percent complete)
- Modifying the sanitary sewer system (completed)
- Performing a fire hazard analysis (completed)
- Preparing an Engineering Assessment and Conceptual Design Report (CDR) (completed)

In addition to the highest priority (Phase I) upgrades, the CMR Building was recognized to require additional upgrading if it is to continue to perform the essential analytical chemistry and metallurgy operations for LANL's existing assignments in a safe, secure, and environmentally sound manner for an additional 20 to 30 years. These further upgrades are not intended to increase the capabilities of the facility nor allow new missions or functions to be located there. These Phase II Upgrades, analyzed in the *Environmental Assessment for the Proposed CMR Building Upgrades* (DOE 1997a) (and also presented in a Capital Asset Management Process Report [LANL 1996c]), include:

- *Seismic and Tertiary Confinement Upgrades.* Diagonal braces from walls to roof, exterior bracing from second floor to ground, internal vertical bracing, strengthening exterior columns, filling in window openings, and adding bracing to the Wing 9 hot cell supports would allow the CMR Building to meet seismic (earthquake resistance) criteria for a Hazard Category 2 facility.
- *Security Upgrades.* Building doorways and other openings would be changed to make human entry other than through the security stations much more difficult.
- *Ventilation Confinement Zone Separation in Wings 1, 3, 5, 7, and 9.* The ventilation systems in these wings would be improved by adding one-way flow baffles and liners in the ventilation ducts, installing better doors and vestibules, adding a new filter tower to Wing 3, and installing a separate glovebox exhaust system. These upgrades are intended to prevent backflow of air carrying radioactive materials and chemical fumes from contaminated areas such as gloveboxes to uncontaminated laboratories, corridors, and offices.
- *Standby Power and Communications Systems.* This upgrade would provide standby electrical power in case a power failure caused the ventilation system to fail. This back up power would maintain negative pressure in the laboratories of Wings 3, 5, 7, and 9, reducing the likelihood that contamination from a laboratory would be spread into other areas. A small generator will provide standby power to the ventilation system and the emergency communication system.
- *Wing 1 Upgrades.* Wing 1 will be decontaminated and a new heating, ventilation, and air conditioning system will

be installed to improve worker health and safety.

- *Operations Center Upgrades.* All building monitoring and control systems will be reported at a central location. This will include continuous air monitors (CAMs), stack monitors and alarms, fire alarm panels, heating, ventilation, and air conditioning and other building utilities, electrical substation switchgear, and glovebox sensors.
- *Chilled Water in Wings 3, 5, and 7.* The 40-year-old evaporative coolers in each wing will be replaced with refrigeration units. Chilled water is supplied to cool process equipment. A chilled water plant will be constructed outside the CMR Building, just west of Wing 1.
- *Main Vault CAMs and Dampers.* Detection capability for radioactive contamination will be enhanced by installing new CAMs in the main vault. The CAMs will be monitored in the CMR Building Health Physics Office. In addition, seismically qualified dampers will be installed in the vault ventilation ducts.
- *Acid Vents and Drains in Wings 3, 5, and 7.* The current acid vents and drains do not rinse or drain completely, allowing radioactive liquid waste residues to stand in nearly horizontal sections of the piping. These systems would be replaced to provide greater slope and better drainage. These wastes are discharged to the RLWTF.
- *Fire Protection Upgrades.* To improve the fire protection system, backflow preventers, fire dampers, and new fire alarm system panels will be installed throughout the CMR Building.
- *Operations Center Standby Power.* A standby generator will provide power to the Operations Center in the event the main system electrical power is lost.
- *Exhaust Duct Washdown Recycle System in Wings 3, 5, and 7.* This planned upgrade is a waste minimization initiative whereby the duct washdown system would be fitted with a system to recycle up to 80 percent of the water used to rinse away materials from the air exhaust that fall out on the duct surfaces. This upgrade is anticipated to decrease the volume of radioactive liquid waste from the duct washdown system by about 450,000 gallons per year (1,700,000 liters per year), to about 120,000 gallons per year (454,300 liters per year).
- *Wings 2 and 4 Safe Standby.* Wings 2 and 4, unneeded to accomplish current mission element assignments, would be placed in safe standby, meaning that loose contamination and some equipment would be removed and the remaining equipment would be placed in a safe and stable condition such that it could not be used.

In its finding of no significant impact regarding the CMR Phase II Upgrades, DOE stated that two potential upgrade designs were encompassed within the environmental assessment (DOE 1997a) analyses: upgrading Wings 3, 5, and 7 without moving office space currently located on the perimeter of each wing; and relocating the office space away from the laboratory functions while upgrading the laboratory space in those wings. In the latter case, two wings would be reconfigured as laboratory space and the third would be put into safe standby condition.

The CMR Phase II Upgrades are funded, and construction is expected to begin in mid 1998. These upgrades were originally scheduled for completion in 2004.

In early 1997, it became apparent that the costs of ongoing (Phase I) upgrades at the CMR Building would overrun the budgeted 1997 costs for that construction project. After considering budget, schedules, and project management issues, LANL, with DOE concurrence, suspended CMR Building Upgrades Project activities pending a thorough budget and project management review (Whiteman 1997). During 1997, several audit and assessment activities were completed by LANL and DOE in which root causes and corrective measures required to address project management issues were identified. Throughout the second half of 1997 and 1998, LANL and DOE have been implementing a series of corrective actions related to improving project management performance on the CMR Building Upgrades Project to allow project activities to resume.

In addition to the information discussed above regarding ongoing and planned upgrades, additional developments occurred during 1997 regarding CMR Building operations. These are highlighted here as contextual information. These developments are consistent with responsibilities and approaches regarding safe operations at LANL, as discussed in section 2.1.3.

On September 2, 1997, in response to safety considerations, LANL temporarily suspended operations within the CMR Building pending an in-depth review of all operations and procedures being implemented within the building to support ongoing LANL activities. During the period from September 1997 through April 1998, operations were resumed in a phased manner as work control and work authorization procedures were verified for each set of operations within the building (Gancarz 1997). Full resumption of CMR Building operations was authorized by DOE on April 17, 1998. To further improve operation of the CMR facility within a safe operating envelope for nuclear facilities, LANL Director Browne announced a new integrated management organization for the CMR Building in which the technical, operations, and facility management of the CMR Building would be integrated with that of TA–55. This reorganization became effective in January 1998 (Browne 1997).

In September 1997, DOE and LANL decided to develop a "Basis for Interim Operations" (BIO) at the CMR facility in lieu of a Safety Analysis Report in order to establish the safety authorization basis for the facility. This effort was completed in October 1998, with the issuance of the BIO and associated technical safety requirements (TSRs) that must be implemented according to a DOE/LANL approved plan over the next 2 years[1]. With the authorization basis established through the BIO, the CMR Building Upgrades Project is responding to meeting the TSR implementation requirements to ensure safe operations with the facility. TSR implementation requires certain facility modifications be completed. Throughout 1998, the CMR Building Upgrades Project was integrated into the BIO/TSR development process. On March 24, 1998, a workshop was held to evaluate CMR Building upgrades required to support BIO/TSR implementation. A second workshop was held on July 17, 1998, to further refine BIO/TSR implementation upgrades and additional upgrades related to safe, reliable operations within the CMR Building.

Based on the above information, the CMR Building Upgrades Project has resumed, and the first priority is the completion of CMR facility modifications required to implement the BIO/TSRs and satisfy compliance requirements. Formal restart of CMR Building Upgrades Project activities commenced on April 13, 1998, with DOE authorizing LANL to initiate activities in support of BIO/TSR implementation that are within the scope of the CMR Building Upgrades Project. Since April 1998, additional project activities have been authorized (repriortized, but within the original scope) by the DOE. Authorized CMR Building Upgrades Project activities since resumption include:

1. The approved CMR BIO includes a comprehensive accident analysis section, including a wing-wide fire scenario that is similar to an accident evaluated in this SWEIS. These analyses were compared, and it was found that, although modeling assumptions and methods varied significantly, the estimated consequences and frequency demonstrated a good agreement. See appendix G, section G.5.6.16, for further details.

- Fire protection panel replacement
- Transient combustible loading reduction
- Motor control centers replacement (completed)
- Duct washdown system refurbishment in Wings 3, 5, and 7
- Interim project management activities

Additional project activities under review or consideration currently include:

- Air compressor replacement
- Hood washdown system installation
- Heating, ventilation and air conditioning (HVAC) DP indicator installation
- Wing 9 ventilation system upgrades
- Emergency personnel accounting system installation
- Stack monitoring upgrades
- Hot cell upgrades, Wing 9 (several subprojects)

A crosswalk between the approved CMR Building Upgrades Project (Phases I and II) baseline and the authorized or under review work in support of the BIO/TSR implementation activities is given in Table 2.2.2.3–2.

All of the above-listed project activities were developed and reviewed during the March and July 1998 workshops. The DOE and LANL are continuing to define all required facility modifications based on ongoing evaluations of site or facility conditions and program requirements to support a rebaselining of the overall CMR Building Upgrades Project during 1999.

In 1996 through 1998, LANL geologists conducted detailed geologic studies in and around TA–3 and TA–55 and geologic trenching studies on the Pajarito Fault. Results from these studies indicate that a possible connection exists between the Pajarito, Rendija

TABLE 2.2.2.3–2.—*CMR Building Upgrades Project Crosswalk Between Phases I and II and 1998 Scope of Work Authorized or Under Review*

BASELINE DESCRIPTION	AUTHORIZED (A) OR UNDER REVIEW (R)
Fire protection upgrades, Phase II	• Fire protection panel replacement (A) • Transient combustible loading reduction (A)
Upgrading basic wing electrical systems, Phase I	Motor control centers replacement (A)
Duct washdown upgrade, Phase I[a]	Condition assessment upgrade (A) Duct washdown system refurbishment, Wings 3, 5, 7[b] (R)
Ventilation confinement zone separation upgrades, Phase II	• Air compressor replacement subsystems controlling HVAC dampers (R) • HVAC delta pressure indicator installation subsystem monitoring HVAC negative pressure (R) • Wing 9 Ventilation system upgrades (R)
Communications upgrades, Phase II	Emergency personnel accounting system (R)
Stack monitors upgrade, Phase I	Stack monitoring upgrades (R)
--	Hot cell upgrades - Wing 9 (R)

[a] Hood washdown upgrades may be addressed under facility operations administrative controls and is currently not included as a subproject.
[b] Only condition assessments for duct washdown have been authorized. Separate authorization will be issued for construction upon completion of assessments.

Canyon, and Guaje Mountain faults, which may increase the likelihood for fault rupture within TA–3 should a seismic event occur (see chapter 4, section 4.2.2.2, and appendix I). The earthquake accident frequencies utilized in appendix G have been compared to that which would be derived considering the results from the geologic mapping and trenching studies. Potential building seismic damage has been addressed for ground shaking and fault rupture, where appropriate, from earthquakes (volume III, appendix G, Table G.5.4–3). The seismic failure frequencies that were used in the accident analysis do not increase significantly as a result of seismic ground rupture. The basis for this conclusion is that the return period (the inverse of frequency) for a damaging fault rupture is significantly greater than the return periods used for damaging ground motion in the accident analysis. Because additional damage could result should a fault rupture occur at the CMR Building, a sensitivity study is performed for this scenario as part of the earthquake analysis (appendix G, SITE–03).

The DOE has decided not to implement the seismic upgrades as part of the CMR Building Upgrades Project, Phase II. This is a result of: (1) new seismic studies published after the draft SWEIS was released that indicated the additional hazard of a seismic rupture at the CMR Building (chapter 4, section 4.2.2.2, and appendix I) and (2) DOE's postponement of the decision to implement the pit manufacturing capability beyond 20 pits per year in the near future. Although the seismic rupture risk does not have a substantial effect on the overall seismic risk, it is an aspect of risk that cannot be cost-effectively mitigated through engineered structural upgrades. Given that assessment, the DOE is considering more substantial actions that are not yet ripe for analysis in the SWEIS (e.g., replacement of aging structures). The overall goal of DOE's evaluation is to ultimately reduce the risk associated with seismic event, should one occur. In the meantime, DOE is taking actions to mitigate seismic risks through means other than seismic upgrades (e.g., minimizing material at risk and putting temporarily inactive material in process into more sturdy containers).

Description of Capabilities

The operational CMR capabilities include both radioactive and nonradioactive substances. Work involving radioactive material (including uranium-235, depleted uranium, thorium-231, plutonium-238, and plutonium-239) is performed inside hoods, hot cells, and gloveboxes. Chemicals such as various acids, carcinogenic materials, and organic-based liquids are used in small quantities, generally in preparation of radioactive materials for processing or analysis.

The principal activities conducted at the CMR Building are described below. The manner in which these activities will vary among the alternatives is described in chapter 3.

Analytical Chemistry. Analytical chemistry capabilities involving the study, evaluation, and analysis of radioactive materials reside at the CMR Building. These activities support research and development associated with various nuclear materials programs, many of which are performed at other LANL locations on behalf of or in support of other sites across the DOE complex (e.g., Hanford Reservation, Savannah River Site, Sandia National Laboratories). Sample characterization activities include assay and determination of isotopic ratios of plutonium, uranium, and other radioactive elements; major and trace elements in materials; the content of gases; constituents at the surface of various materials; and methods to characterize waste constituents in hazardous and radioactive materials.

Uranium Processing. Operations essential for the stewardship of uranium products are conducted at this facility. They include uranium processing (casting, machining, and reprocessing operations, including research and development of process improvements and characteristics of uranium and uranium compounds), and the handling and storage of high radiation materials. The facility also provides limited backup to support the nuclear materials management needs for activities at TA–55 and also provides pilot-scale unit operations to back up the uranium technology activities at the Sigma Complex (described in section 2.2.2.5), other LANL facilities, and other DOE sites.

Destructive and Nondestructive Analysis. Destructive and nondestructive analysis employs analytical chemistry, metallographic analysis, measurement on the basis of neutron or gamma radiation from an item, and other measurement techniques. These activities are used in support of weapons quality, component surveillance, nuclear materials control and accountability, SNM standards development, research and development, environmental restoration, and waste treatment and disposal.

Nonproliferation Training. LANL utilizes measurement technologies at the CMR Building and other LANL facilities to train international inspections teams for the International Atomic Energy Agency. Such training may use SNM.

Actinide Research and Processing. Actinide research and processing at the CMR Building typically involves solids, or small quantities of solution. However, any research involving highly radioactive materials or remote handling may use the hot cells that are in Wing 9 of the CMR Building to minimize personnel exposure to radiation or other hazardous materials. CMR actinide research and processing may include separation of medical isotopes from targets, processing of neutron sources (DOE 1995d), and research into the characteristics of materials, including the behavior or characteristics of materials in extreme environments (e.g., high temperature or pressure).

Fabrication and Metallography. Fabrication and metallography at the CMR Building involves a variety of materials, including hazardous and nuclear materials. Much of this work is done with metallic uranium. The CMR Building can fabricate and analyze a variety of parts, including targets, weapon components, and parts used for a variety of research and experimental tasks.

2.2.2.4 *Pajarito Site: Los Alamos Critical Experiments Facility (TA–18)*

The Los Alamos Critical Experiments Facility (LACEF) and other experimental facilities are located at TA–18, which is known as Pajarito Site. TA–18 facilities are 3 miles (4.8 kilometers) from the nearest residential area, White Rock, and 0.25 miles (400 meters) from the closest technical area (Figure 2.2.2.4–1 and Table 2.2.2.4–1). These facilities are in a canyon near the confluence of Pajarito Canyon and Threemile Canyon. Some natural shielding is afforded by the surrounding canyon walls that rise approximately 200 feet (61 meters) on three sides.

Description of Facility

The facility consists of a main building, three outlying remote-controlled critical assembly buildings known as kivas, and several smaller laboratory, nuclear material storage, and support buildings. Kivas #1, #2, and #3 are Category 2 nuclear facilities. Each kiva is surrounded by a fence to keep personnel at a safe distance during criticality experiments, and the entire site is bounded by a security fence to aid in physical safeguarding of SNM. Site access is through a guarded portal.

The main laboratory building (Building 30) houses offices for group management, staff, and health physics personnel. There are several radioactivity counting rooms, an electronic

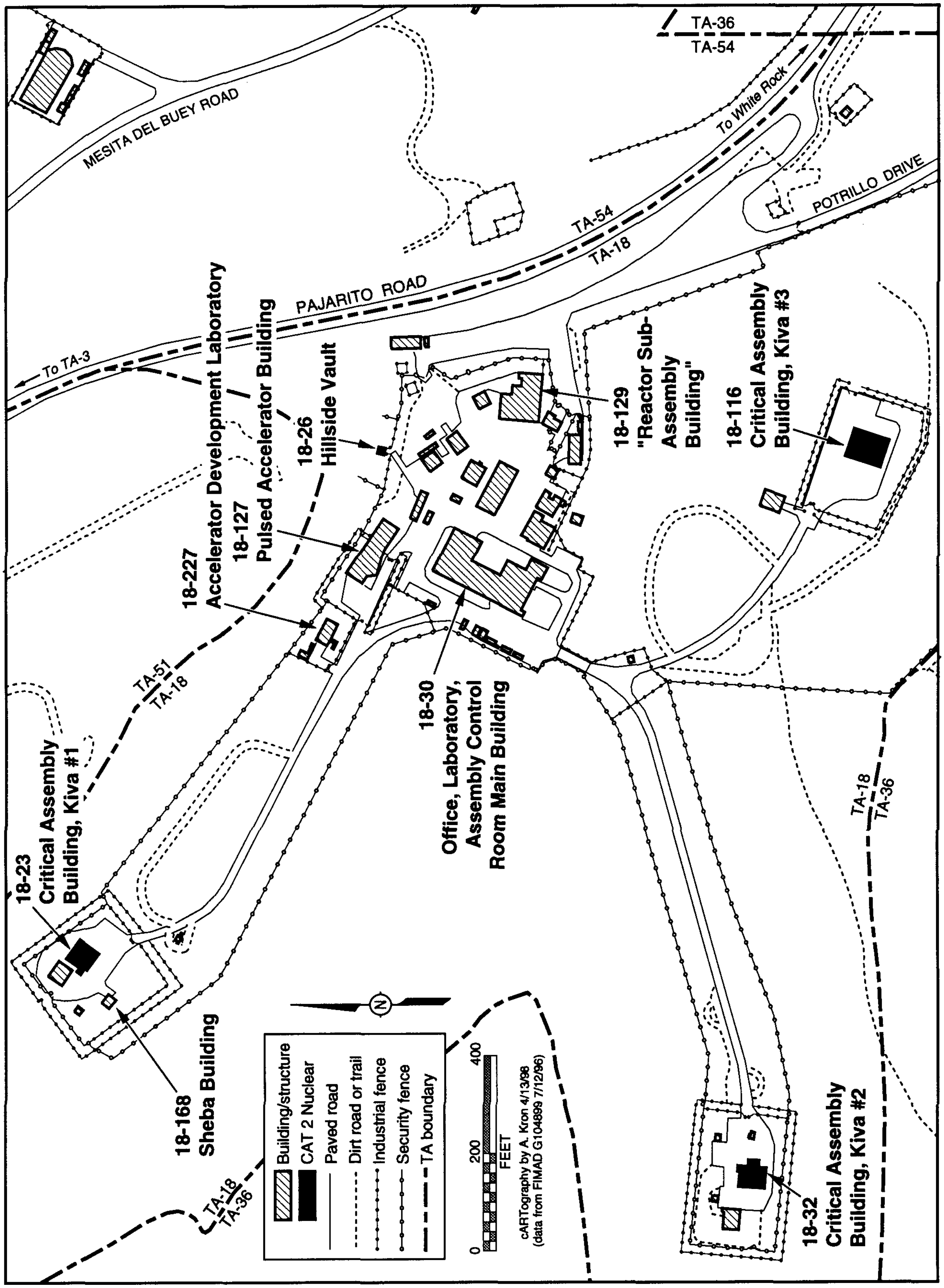


FIGURE 2.2.2.4–1.—*TA–18 Pajarito Site.*

TABLE 2.2.2.4–1.—*Principal Buildings and Structures of the Pajarito Site*

TECHNICAL AREA	PRINCIPAL BUILDINGS AND STRUCTURES
TA–18	Warehouse: 18–28 Main Building: 18–30 Pulsed Accelerator Building: 18–127 Reactor Subassembly Building[a]: 18–129 Critical Assembly Kivas: 18–23, 18–32, 18–116 Vault: 18–26 Sheba Building: 18–168 Accelerator Development Laboratory: 18–227

[a] This is a historical name. This building is currently used for detector development and calibration and has never housed a nuclear reactor.

assembly area, the site machine shop, and the critical assembly control rooms in Building 30. Other support buildings are the Hillside Vault (Building 26) for nuclear material storage, the Pulsed Accelerator Building (Building 127) for projects requiring a "clean" radiation environment, and Building 129 for detector development and calibration.

Description of Capabilities

The principal TA–18 activities are the design, construction, research, development, and applications of critical experiments (that is, experiments having to do with nuclear criticality). These are conducted using five types of assemblies:

- Benchmark critical assemblies
- General purpose assembly machines
- Solution assemblies (which use fissile solutions)
- Prototype low power reactor assemblies (these do not need heat rejection systems)
- Fast-burst assemblies for producing fast-neutron pulses

TA–18 activities also include development, training, and applying nuclear diagnostic and accountability techniques. Nuclear materials control and handling, waste characterization, and criticality experiments are areas of particular interest. The Nuclear Emergency Search Team, Strategic Defense Initiative Program, and the Strategic Arms Reduction Treaty Verification Group all utilize TA–18 in fulfilling their program requirements. The TA–18 staff trains personnel from a variety of occupations and several countries in criticality safety as well as radiation detection and instrumentation.

Since 1948, thousands of criticality experiments and measurements have been performed at LACEF on assemblies using uranium-233, uranium-235, and plutonium-239 in various configurations, including nitrate, sulfate, and oxide compounds as well as solid, liquid, and gas forms. Critical assemblies at LACEF are designed to operate at low-average power and at temperatures well below phase change transition temperatures (which sets them apart from normal reactors) with low fission production and a minimal inventory. These assemblies are very flexible in terms of fuel loading, configuration, and the types and forms of material that can be used for experiments. Since these assemblies do not require forced convection cooling, a potential source of stored energy and fission products is eliminated. Post-shutdown cooling is unnecessary, and experiments are "walk-away" safe. Machine designs are relatively simple with the prime requirement being that operations are remotely controlled from a control room in Building 30 or from behind thick shielding.

Experiments employ fissile species such as uranium-233, uranium-235, and plutonium-239. Between experiments, these special nuclear materials are stored in designated storage areas at kivas or in the Hillside Vault.

Nuclear material is moved by truck to and from TA–18 over public roads in U.S. Department of Transportation (DOT)-approved shipping containers or using road closures on an as-required (infrequent) basis. The on-site TA–18 nuclear materials inventory is relatively stable, and consists primarily of isotopes of plutonium and uranium. The bulk of the plutonium is solid and is either clad or encapsulated; plutonium oxide is doubly canned. The use of toxic and hazardous chemicals is limited.

The criticality experiments generate very small amounts of fission products and there is essentially no radioactive waste. Criticality experiments do not release significant emissions to the atmosphere at the site.

The principal sets of experimental activities conducted at TA–18 are described below. The manner in which these activities would vary under each of the alternatives is described in chapter 3.

Dosimeter Assessment and Calibration. TA–18 critical assemblies are used to evaluate the performance of personnel radiation dosimeters. Nuclear accident dosimetry studies are conducted using the critical assembly radiation to simulate criticality accident radiation. The facility hosts national dosimetry intercomparison studies involving personnel and dosimeters from DOE and private nuclear facilities.

Detector Development. TA–18 personnel have developed and built nuclear materials detection instruments used to monitor pedestrians and vehicles, as well as hand-held and field-deployable neutron and gamma-ray detectors. TA–18 personnel also operate a simulation facility in which nuclear materials can be configured to develop and validate instruments and methods used in nuclear nonproliferation programs.

A new method of monitoring alpha-particle-emitting nuclear materials is undergoing development at TA–18 along with the development of detectors that can help assess potential threats from terrorist organizations. TA–18 personnel also train nuclear emergency search team personnel in the use of these instruments.

Materials Testing. The TA–18 facilities are used to characterize and evaluate materials, primarily by measuring the nuclear properties of these materials. The materials evaluated are typically structural materials or those to be used as shielding or neutron absorbers. Materials testing typically involves use of radiation sources or critical assemblies as radiation generators and measurement of radiation levels under a variety of conditions.

Subcritical Measurements. Subcritical measurements are those done on arrays of fissile material that are below the critical mass for material in a given form. Subcritical experiments may vary any or all of the factors that influence criticality (mass, density, shape, volume, concentration, moderation, reflection, neutron absorbers, enrichment, and interactions). Associated measurement techniques involve measuring some aspect of the neutron or gamma population in the material to assess its criticality state.

Fast-Neutron Spectrum. TA–18 has bare and reflected metal critical assemblies that operate on a fast-neutron spectrum. These assemblies typically have irradiation cavities in which flux foils, small replacement samples, or small experiments can be inserted. Typical experiments include evaluation of the reactivity of material samples, irradiation of novel neutron and gamma measuring instrumentation, and testing and calibrating radiation dosimeters.

Dynamic Measurements. Two fast-pulsed assemblies at TA–18 produce controlled, reproducible pulses of neutron and gamma radiation from tens of microseconds to several tens of milliseconds in duration. These pulses are useful for applications such as neutron physics measurements, instrumentation development, dosimetry, and materials testing.

Skyshine Measurements. The study of skyshine (radiation transported point to point without a direct line of sight) is a component of dosimetry primarily applicable to neutron producing processes and facilities. TA–18 uses critical assemblies to produce radiation fields to mimic those found around nuclear weapons production and dismantlement facilities, in storage areas, and in experimental areas.

Vaporization. The fast-pulsed assemblies at TA–18 have the capability of vaporizing fissile materials placed in a thermalizing material next to the assembly or in an internal cavity. These vessels are placed inside multiple containment vessels to prevent leakage of vaporized materials and fission products. This capability is useful for testing materials, measuring the properties of fissile materials, and testing reactor fuel materials in simulated accident conditions.

Irradiation. Several critical assemblies at TA–18 can have varying spectral characteristics in both steady state and pulsed modes. These assemblies are typically used for irradiating fissile materials and other materials with energetic responses for the purposes of testing and verifying computer code calculations.

2.2.2.5 *Sigma Complex (TA–3–66, TA–3–35, TA–3–141, and TA–3–159)*

The Sigma Complex consists of the main Sigma Building (Building 66) and its associated support structures, including the Beryllium Technology Facility (Building 141), the Press Building (Building 35), and the Thorium Storage Building (Building 159) (see Figure 2.2.2.5–1 and Table 2.2.2.5–1).

The Sigma Complex supports a large, multi-disciplinary technology base in materials fabrication science. This facility is used mainly for materials synthesis and processing, characterization, fabrication, joining, and coating of metallic and ceramic items. These capabilities are applied to a variety of materials, including uranium (depleted uranium and enriched uranium), lithium, and beryllium; the Sigma Complex is equipped to handle such materials safely. The current activities focus on limited production of special (unique or unusual) components, test hardware, prototype fabrication, and materials research in support of DOE programs in national security, energy, environment, industrial competitiveness, and strategic research. The Sigma Complex also provides support to research and development activities conducted elsewhere at LANL by constructing special pieces of equipment and test items.

Description of Facilities

The Sigma Building is designated as a Hazard Category 3 nuclear facility. The Sigma Building was built in 1958 and 1959, with an addition constructed in the late 1980's. It contains four levels and approximately 168,200 square feet of floor space (15,626 square meters). The Sigma Building is composed of four sectors. Three sectors built in the late 1950's were not constructed to current seismic design criteria (seismic upgrades are included in all alternatives). The fourth sector,

TABLE 2.2.2.5–1.—*Principal Structures and Buildings in the Sigma Complex*

TECHNICAL AREA	PRINCIPAL STRUCTURES AND BUILDINGS
TA–3	Sigma Building: 3–66 Press Building: 3–35 Beryllium Technology Facility: 3–141 Thorium Storage Building: 3–159

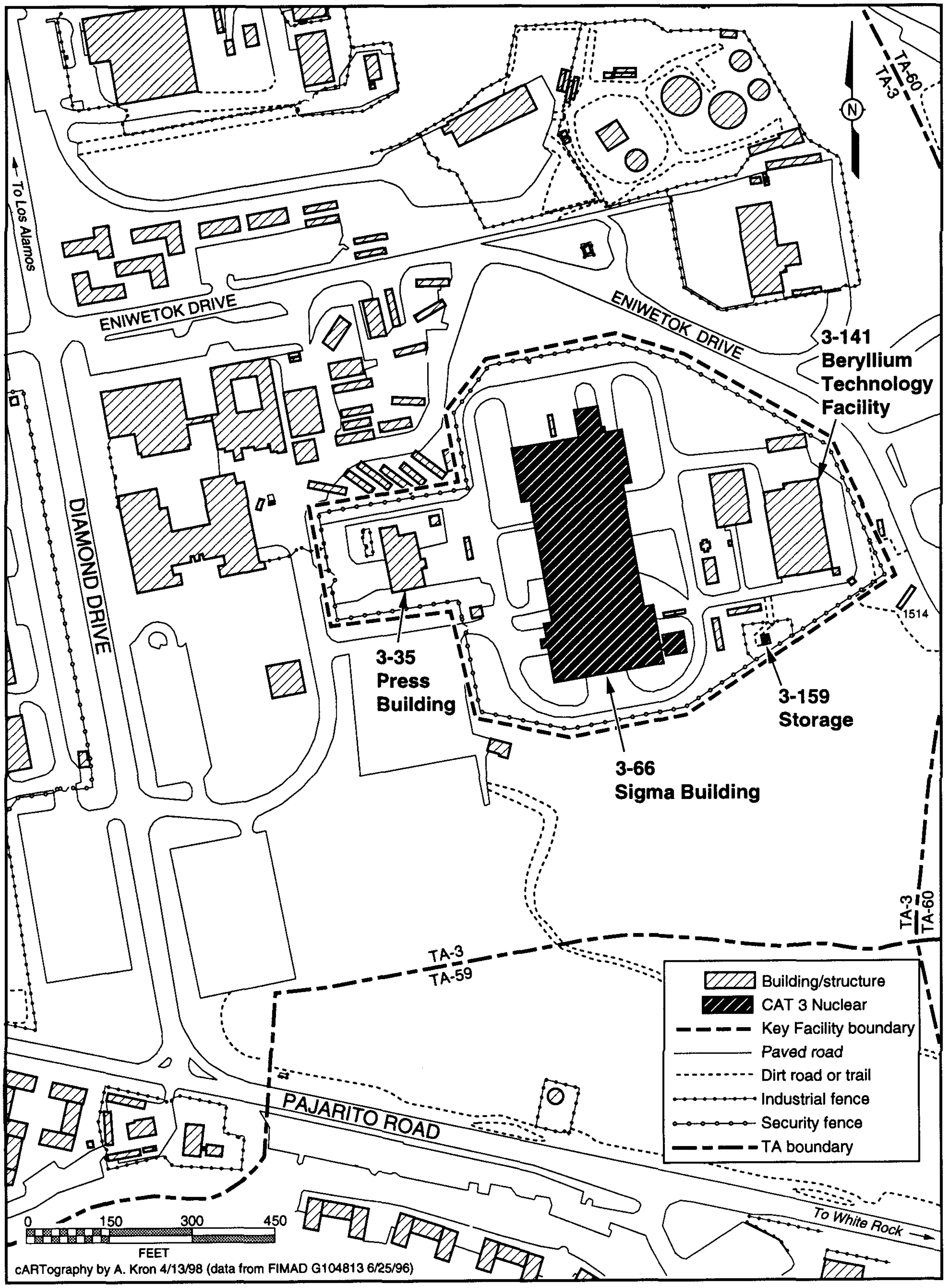


FIGURE 2.2.2.5–1.—*The Sigma Complex in TA–3.*

built in the late 1980's, meets current seismic design criteria. Hazardous chemicals such as concentrated acids and caustic solutions are used and stored at the Sigma Building. Sigma Building air exhausts through six major exhaust stacks and through numerous roof exhausts. Aqueous waste from enriched uranium processing and liquid chemical waste are routed to the RLWTF at TA–50 (described in section 2.2.2.14). Most of the liquid waste from the Sigma Complex is generated from the electroplating operation at the Sigma Building. Electrodeposition solutions are now vacuum distilled and re-used; the sludges are managed as RCRA wastes.

The Beryllium Technology Facility (3-141), formerly called the Rolling Mill Building, was built in the early 1960's and encompasses approximately 20,213 square feet (1,878 square meters) on three levels. This building does not have a hazard designation. The two sectors of the building meet current seismic design criteria. The building houses powder metallurgy activities, filament welding, ceramics research and development, and rapid solidification research. Fabrication work using beryllium and uranium/graphite fuels is performed here. The beryllium area has a permitted, monitored stack equipped with a HEPA filtered exhaust air system.

The Press Building (3-35) was built in 1953 and contains approximately 9,860 square feet (916 square meters) of space located on one floor and a partial basement. This building does not have a hazard designation and was not evaluated for seismic capability. A 5,000-ton (4,536-metric-ton) hydraulic press used for work with depleted uranium is operated here. One stack exhausts through HEPA filters. The exhaust stream is monitored for radioactive emissions. Aqueous waste from uranium processing and other nonhazardous operations is routed, via a pipeline, to the RLWTF at TA–50.

The Thorium Storage Building is designated as a Hazard Category 3 nuclear facility. Thorium is stored here, in both ingot and oxide form. This building is very small and was not evaluated for seismic capability.

Description of Capabilities

The primary activities conducted within the Sigma Complex are described below. The manner in which these activities would vary under each of the alternatives is described in chapter 3.

Research and Development on Materials Fabrication, Coating, Joining, and Processing. Materials synthesis and processing work addresses research and development on making items out of materials that are difficult to work with. The processes include applying coatings and joining materials using plasma, arc welding and other techniques. The materials used in fabrication are also reprocessed (i.e., separated into pure forms for reuse or storage).

Characterization of Materials. Materials characterization work includes understanding the properties of metals, metal alloys, ceramic-coated metals, and other similar combinations along with the effects on these materials and properties brought about by aging, chemical attack, mechanical stresses, and other agents.

Fabrication of Metallic and Ceramic Items. Materials fabrication includes work with metallic and ceramic materials, and combinations thereof. Items are fabricated out of uranium, both depleted and enriched in uranium-235. Stainless steel, lithium, various ceramics, and beryllium items are also fabricated. Items are fabricated on a limited production basis as well as one-of-a-kind and prototype pieces. One specific set of applications for this technology is the fabrication of nonnuclear weapons components. The responsibility for production of these components was assigned to LANL on the basis of the *Nonnuclear Consolidation*

Environmental Assessment (DOE 1993). This environmental assessment (EA) addressed the upgrades an interior modifications necessary for this assignment, and these upgrades and modifications are expected to continue through completion under all of the SWEIS alternatives (as identified in chapter 3).

2.2.2.6 *Materials Science Laboratory (TA–3–1698)*

The Materials Science Laboratory (MSL, TA–3–1698) is located in an unrestricted access area at the southeastern edge of TA–3 (Figure 2.2.2.6–1 and Table 2.2.2.6–1). The facility is a two-story modern laboratory of approximately 55,360 square feet of floor space (5,143 square meters) arranged in an H-shape. It is designed to accommodate scientists and researchers, including participants from academia and industry whose focus is on materials science research. The *Environmental Assessment for the Materials Science Laboratory* (DOE 1991) details the impacts of the new facility. The completion of the top floor of the MSL was planned and was included in the environmental assessment, but not funded in 1992. Completion of this floor is still desired but is not currently scheduled.

Description of Facilities

The MSL consists of 27 laboratories, 15 support rooms, 60 offices, 21 distinct materials research areas, and several conference rooms that are used by technical staff, visiting scientists and engineers, administrative staff, and building support personnel. It is constructed of precast concrete panels sealed to a structural framework, with concrete floors, drywall interior, casework, hoods, and a utility infrastructure. Safety controls throughout the complex include a wet-pipe sprinkler system, automatic fire alarms, chemical fume hoods, gloveboxes, HEPA-filtered heating, ventilation, and air conditioning, and safety showers.

TABLE 2.2.2.6–1.—*Principal Buildings and Structures of Materials Science Laboratory*

TECHNICAL AREA	PRINCIPAL BUILDINGS AND STRUCTURES
TA–3	Materials Science Laboratory: 3–1698

Limited quantities of radioactive isotopes are used at MSL. These include small quantities of solid sodium, zirconium, and depleted uranium. Because of the diversity of research within MSL, a large variety of small quantities of nonradioactive, toxic, and hazardous materials are also used. This is similar to the corrosive and reactive chemicals typically used to synthesize and clean materials in wet chemistry or mechanical property laboratories. For example, semiconductor additives such as tantalum metal and tungsten compounds, along with chromic acid and perchloric acid for metallography activities, are used in gloveboxes or fume hoods. Other acids such as hydrofluoric, phosphoric, and sulfuric, are used in various materials preparation activities and in laser operations. Small amounts of typical laboratory organic chemicals such as acetone, methyl alcohol, and methyl ethyl ketone are also used in MSL activities.

Description of Capabilities

There are four major types of experimentation supported at MSL: materials processing, mechanical behavior in extreme environments, advanced materials development, and materials characterization. These four areas, each of which are described below, contain over 20 capabilities that support materials research for DOE programs. Collaboration with private industry is also an important feature of much of the work performed at MSL. The manner in which these activities vary among the alternatives is described in chapter 3.

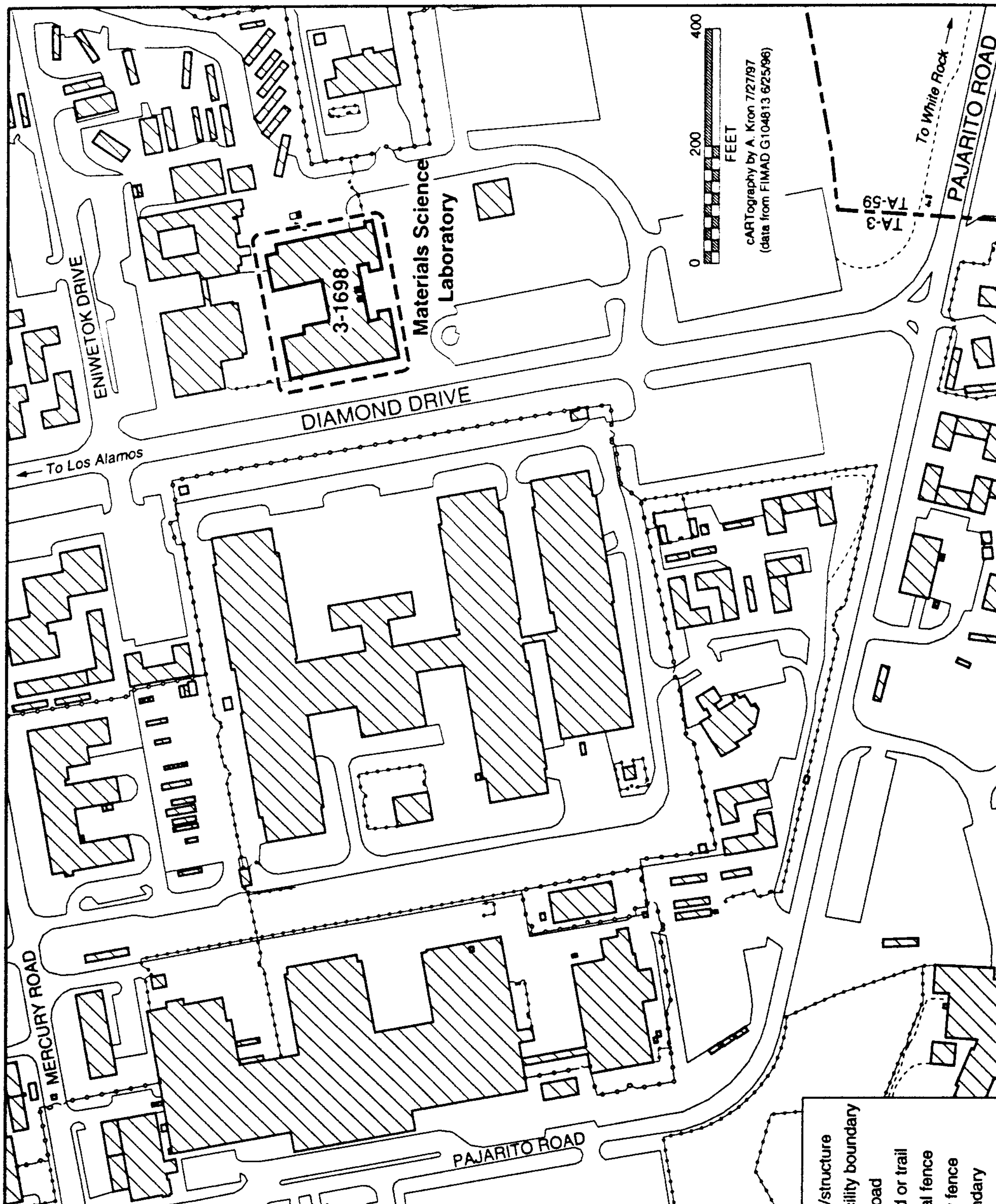


FIGURE 2.2.2.6–1.—*Materials Science Laboratory.*

Materials Processing. MSL supports the formulation of a wide range of useful materials through the development of materials fabrication and chemical processing technologies. The following synthesis and processing techniques represent some of the capabilities available in MSL for this area of research: wet chemistry, thermomechanical processing, materials handling, microwave processing, heavy equipment materials processing, single crystal growth synthesis, amorphous alloys, tape casting, inorganic synthesis, and powder processing.

Some of the laboratories, housing heavy equipment for novel mechanical processing of powders and non-dense materials, are configured to explore net shape and zero-waste manufacturing processes. Several laboratories are dedicated to the development of chemical processing technologies, including recycling and reprocessing techniques to solve current environmental problems.

Mechanical Behavior in Extreme Environments. The mechanical testing laboratories contain equipment for subjecting materials to a broad range of mechanical loadings to study their fundamental properties and characterize their performance. The laboratories utilized for this major area of materials science include dedicated space for mechanical testing; mechanical fabrication, assembly and machining research; metallography; and dynamic testing.

The mechanical testing laboratory offers capabilities to study multiaxial, high temperature, and high load behaviors of materials. The assembly areas consist of metalworking and experimental assembly areas that house a variety of electrically or hydraulically powered machines that twist, pull, or compress samples. The most energetic of these is a gas launcher, which projects a sample against an anvil at very high velocities. The MSL dynamic materials behavior laboratory is utilized by researchers for the study of high deformation rate behaviors. The dynamic testing equipment allows materials to be subjected to high rate loadings, including impact up to 1.2 miles (2 kilometers) per second. The metallography area contains equipment for sectioning, mounting, polishing, and photographing samples.

Advanced Materials Development. The various laboratories are configured for the exploration of new materials for high strength and high temperature applications. Many of the laboratories support synthesis and characterization of single crystals, nanophase, and amorphous materials, as well as providing areas for ceramics research including solid state, inorganic chemical studies involving materials synthesis. A substantial amount of effort in this area is dedicated to producing new high-temperature superconducting materials. MSL also provides facilities for synthesis and mechanical characterization of materials systems for bulk conductor applications.

Materials Characterization. Materials characterization provides the ability to understand the properties and processing of materials and to apply that understanding to materials development. MSL contains a collection of spectroscopy, imaging, and analysis tools for characterizing advanced materials. The electron microscopy laboratory area has four microscopes to characterize subnanometer to micrometer structures, including chemical analysis and high resolution electron holography. The optical spectroscopy laboratory allows ultrafast and continuous wave tunable resonance Raman scattering spectroscopy, high-resolution Fourier Transform Infrared absorption, and ultraviolet (UV) visible to near infrared (IR) absorption spectroscopy. The x-ray laboratory allows for the study of samples at temperatures up to 4,892°F (2,700°C) and pressures up to 80 kilobar. A metallography and ceramography support laboratory has the latest equipment for optical characterization. A laboratory area is provided to support surface-science study and corrosion characterization of materials.

2.2.2.7 *Target Fabrication Facility (TA–35)*

The Target Fabrication Facility (TFF) is approximately 61,000 square feet (5,667 square meters) of floor space with approximately 48,000 square feet (4,459 square meters) of laboratory area and 13,000 square feet (1,208 square meters) of office area (Figure 2.2.2.7–1 and Table 2.2.2.7–1). TFF is a two-story structure sited at TA–35 (Building 213) immediately to the east of TA–55, directly north of TA–50. Laboratories and offices occupy both the ground (lower) floor and the upper floor. In general, the structure is reinforced concrete. Vibration sensitive areas are supported on isolated concrete slabs. The HVAC system maintains a negative pressure (i.e., a pressure that is less than the pressure of the atmosphere outside the building) in the laboratories with both room air and hood exhaust vented to the atmosphere through filtered and, until 1995, monitored exhaust stacks. In 1995, monitoring was terminated when it was determined through analyses that monitoring was not required because of low facility chemical and radioactive material inventories. Sanitary waste is piped to the sanitary waste disposal plant near TA–46. Radioactive liquid waste and liquid chemical waste are shipped to TA–50 using a direct pipeline.

TABLE 2.2.2.7–1.—*Principal Buildings and Structures of Target Fabrication Facility*

TECHNICAL AREA	PRINCIPAL BUILDINGS AND STRUCTURES
TA–35	Target Fabrication Facility: 35–213

Description of Facilities

TFF maintains a beryllium machining capability used to manufacture structural shapes from beryllium. TFF is not a nuclear facility. Tritium was removed from the facility in 1993; however, operations involving tritium-contaminated materials are ongoing. Tritium contamination levels are low and are controlled below levels that would make this a nuclear facility. Depleted uranium coatings are no longer applied at TFF. Although a large number of chemicals are used, they are used in small quantities. TFF is designated as a moderate hazard chemical facility. The design for earthquake loads is in accordance with current applicable standards. Transportation in and out of the TFF consists of occasional deliveries and waste pickup typical of a research and development facility.

TFF houses the equipment and personnel for precision machining, physical vapor deposition, chemical vapor deposition, polymer sciences, and assembly of targets for inertial confinement fusion and physics experiments. These capabilities are complemented by personnel and equipment capable of performing high-technology material science, effects testing, characterization, and technology development.

Description of Capabilities

The three primary activities located at TFF are described below. The manner in which these activities would vary among the alternatives is described in chapter 3.

Precision Machining and Target Fabrication. Precision machining operations produce sophisticated devices consisting of very accurate part shapes and often optical quality surface finishes. A variety of processes are used to produce the final parts, which include conventional machining, ultra-precision machining, lapping, and electron discharge machining. Dimensional inspections are performed during part production using a

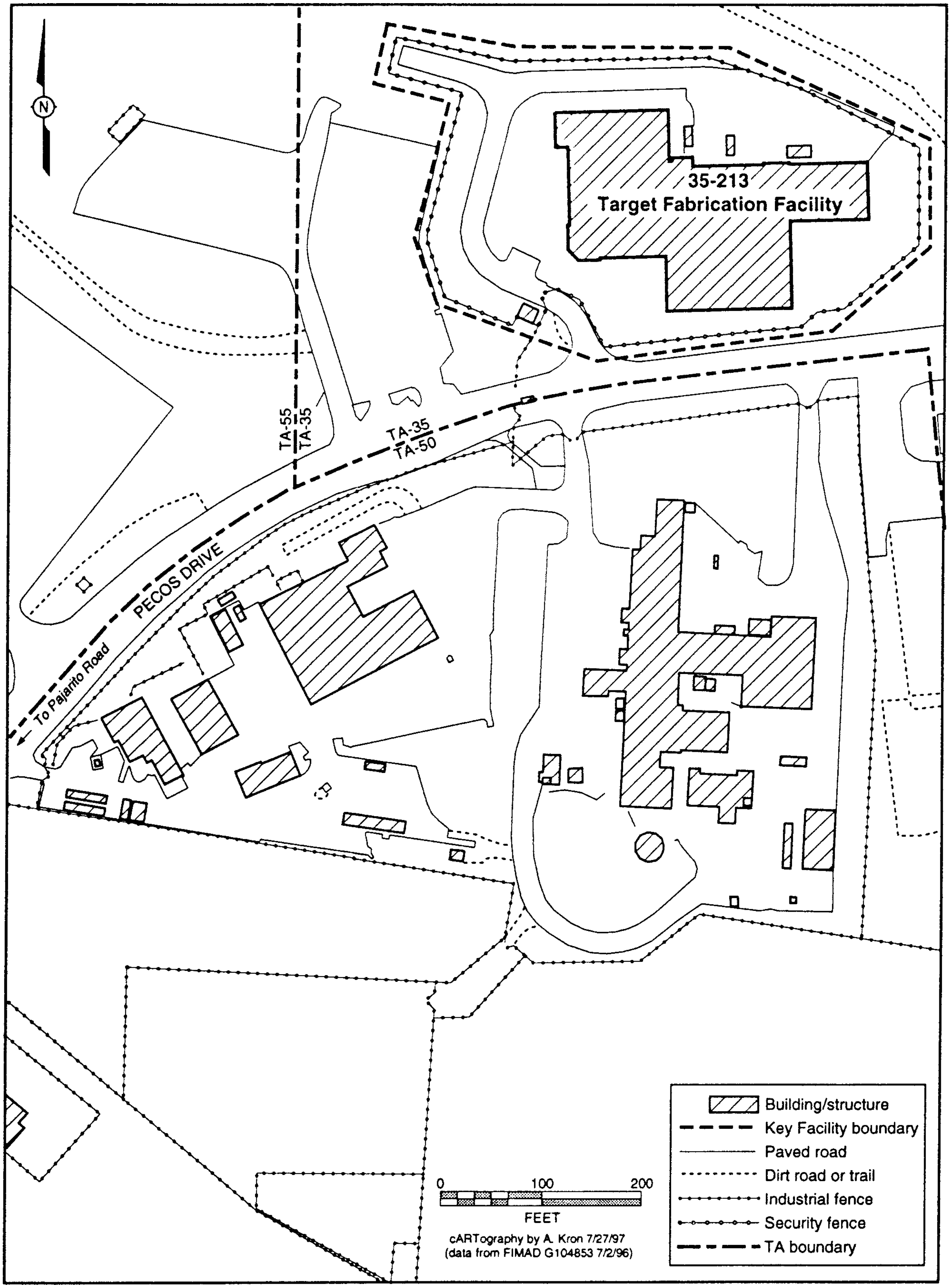


FIGURE 2.2.2.7–1.—*Target Fabrication Facility.*

variety of mechanically and optically based inspection techniques.

Polymer Synthesis. Polymer synthesis science formulates new polymers, studies their structure and properties, and fabricates them into various devices and components. Capabilities exist at TFF for developing and producing polymer foams by organic synthesis, liquid crystalline polymers, polymer host dye laser rods, microfoams and composite foams, high energy density polymers, electrically conducting polymers, chemical sensors, resins and membranes for actinide and metal separations, thermosetting polymers, and organic coatings. The materials and devices are typically prepared using solvents at temperatures ranging from 68° to 302°F (20° to 150°C) or by melt processing at temperatures from room temperature up to 572°F (300°C). A wide variety of analytical techniques are used to determine the structure and behavior of polymers, including spectroscopy, microscopy, x-ray scattering, thermal analysis, chromatography, rheology, and mechanical testing.

Chemical and Physical Vapor Deposition. Chemical vapor deposition (CVD) and chemical vapor infiltration (CVI) are processes used to produce metallic and ceramic bulk coatings, various forms of carbon (including pyrolytic graphite, amorphous carbon, and diamond), nanocrystalline films, powder coatings, thin films, and a variety of shapes up to 3.5 inches (9 centimeters) in diameter and 0.5 inches (1.25 centimeters) in thickness. CVD and CVI coating processes are routine operations that use a variety of techniques such as thermal hot wall, cold wall and fluidized bed techniques, laser assisted, laser ablation, radio frequency and microwave plasma techniques, direct current glow discharge and hollow cathode, and organometallic CVD techniques. The CVD process is used to produce thin film metallic, carbide, oxide, sulfide and nitride coatings. TFF scientists have also studied infiltrated materials using isothermal, thermal gradient, forced flow and plasma techniques. Polymer processing and extensive characterization is performed in conjunction with this work and occasionally, highly toxic substances such as nickel carbonyl, iron carbonyl, or arsenic hydride are handled.

Physical Vapor Deposition capabilities at TFF can apply layers of various materials on sophisticated devices with high precision. These layers, applied by various coating techniques, include a wide range of metals and metal oxides as well as some organic materials. Beryllium coatings applied to substrates by magnetron sputtering (performed in a specially ventilated vacuum chamber with HEPA filtered exhaust) is an example of physical vapor deposition performed at TFF.

2.2.2.8 *Machine Shops (TA–3)*

The main machine shops complex consists of two structures in the southwestern quadrant of TA–3: TA–3–39 and TA–3–102 (Figure 2.2.2.8–1 and Table 2.2.2.8–1). The two buildings are connected by a 125-foot (38-meter) long corridor. The machine shops provide special (unique or unusual) parts in support of other activities throughout LANL.

Description of Facilities

Building TA–3–39, the Beryllium Shop, was constructed in 1953, has a total floor space of approximately 134,000 square feet (12,449 square meters), and contains a variety of milling machines, vertical and horizontal lathes, surface grinders, internal and external grinders and assorted saws, laser cutter with

TABLE 2.2.2.8–1.—*Principal Buildings and Structures of Main Machine Shops*

TECHNICAL AREA	PRINCIPAL BUILDINGS AND STRUCTURES
TA–3	Machine Shops: 3–39 Machine Shops: 3–102

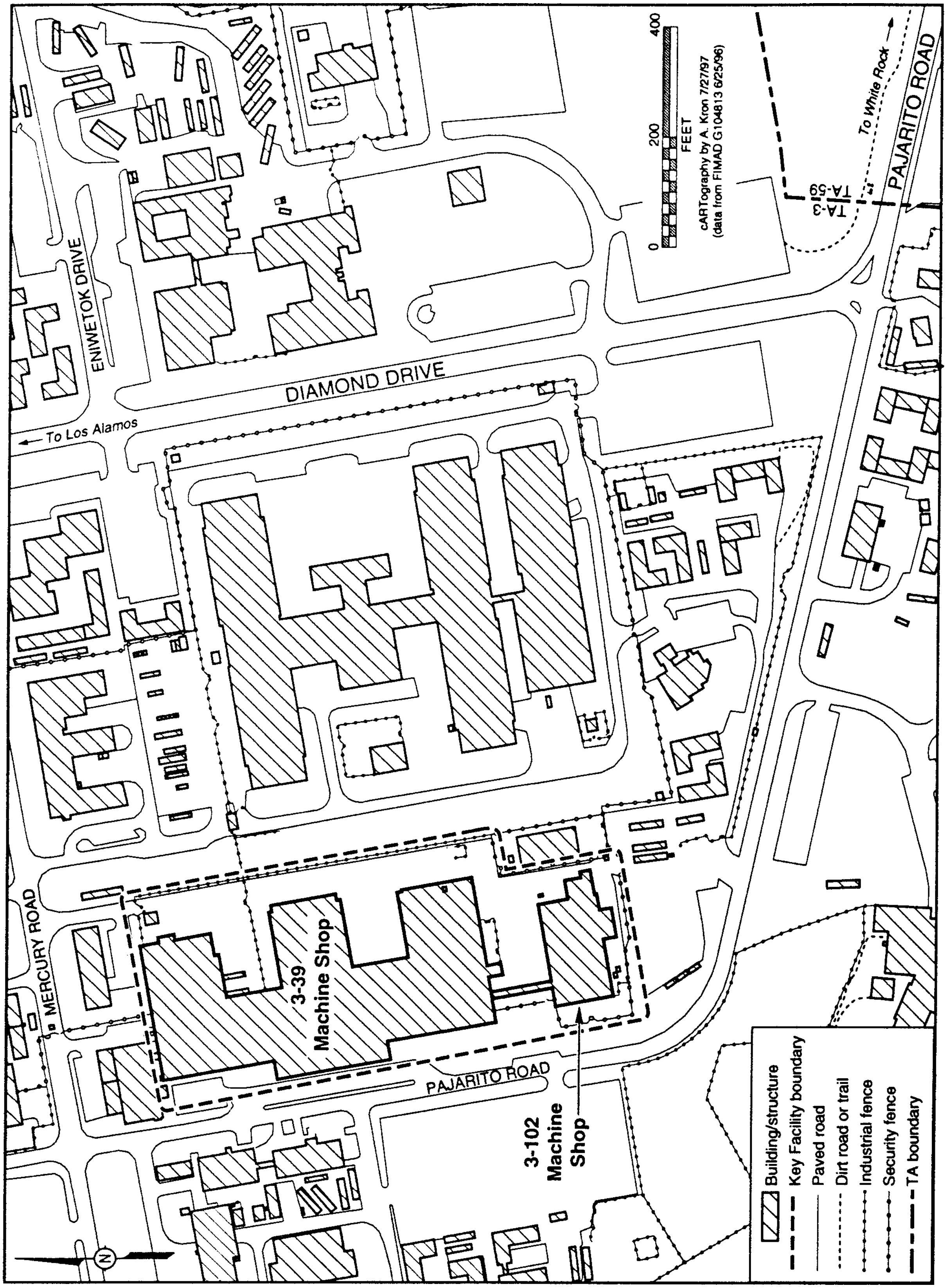


FIGURE 2.2.2.8–1.—*Main Machine Shops.*

welders, welding operations, and measuring equipment (Table 2.2.2.8–1). The Uranium Shop, TA–3–102, constructed in 1957, has a total floor space of approximately 12,500 square feet (1,161 square meters) and, like TA–3–39, contains a variety of metal fabrication machines.

The turnings and fines from depleted uranium fabrication result in a limited volume of radioactive waste. The use of depleted uranium is restricted to Building TA–3–102. While depleted uranium represents the bulk of the materials used, many other potentially hazardous materials (with toxic and pyrophoric characteristics) are used in this facility. These include materials such as beryllium and lithium compounds.

Description of Capabilities

Historically, LANL has maintained a prototype capability in support of research and development for nearly all of the components (parts) in nuclear weapons that are designed at LANL. The capabilities at the machine shops complex are: fabrication of specialty components, fabrication using unique or exotic materials, and dimensional inspection of the fabricated components. Each of these activities is described below. The manner in which these activities would vary among the alternatives are described in chapter 3.

Fabrication of Specialty Components. The fabrication of specialty components is the primary purpose for the existence of the machine shops complex. Specialty components are unique, unusual, or one-of-a-kind parts, fixtures, tools, or other equipment. These include components or equipment used in the destructive testing, replacement parts for the Stockpile Management Program, and gloveboxes for a variety of applications.

Fabrication Using Unique Materials. Fabrication using unique or exotic materials is one of the more important features of the machine shops complex. The list of unusual or unique materials routinely used includes depleted uranium, beryllium, and lithium (an extremely reactive material) and its compounds.

Dimensional Inspection of Fabricated Components. Dimensional inspection of the finished component is a standard step in the fabrication process and involves numerous measurements to ensure that the component is of the correct size and shape to fit into its allotted space and perform its intended function.

2.2.2.9 *High Explosives Processing*

The High Explosives (HE) Research and Development and Processing Facilities are located in parts of TA–8, TA–9, TA–11, TA–16, TA–22, TA–28, and TA–37 (Figures 2.2.2.9–1 through 2.2.2.9–8). These facilities were originally designed and built for production-scale operations during the early and mid 1950's and produced HE components for nuclear weapons in the U.S. stockpile reserve for several years (Table 2.2.2.9–1). LANL has historically upgraded and modernized processing equipment in these facilities to provide prototype HE components to meet the needs of the Nevada Test Site (NTS) program, hydrodynamic tests at LANL, detonator design and production, and other HE activities. Over the last few years, LANL has typically fabricated an average of 1,000 to 1,500 HE parts a year. With reductions in funding, many operations are being consolidated to reduce the number of buildings that must be maintained and the number of workers required.

Description of Facilities

TA–9 facilities with over 60,000 square feet (5,574 square meters) of floor space support HE synthesis, formulation, and characterization operations, as well as HE-related analytical chemistry, safety testing, process development, and stockpile surveillance. TA–16 facilities with over 280,000 square feet

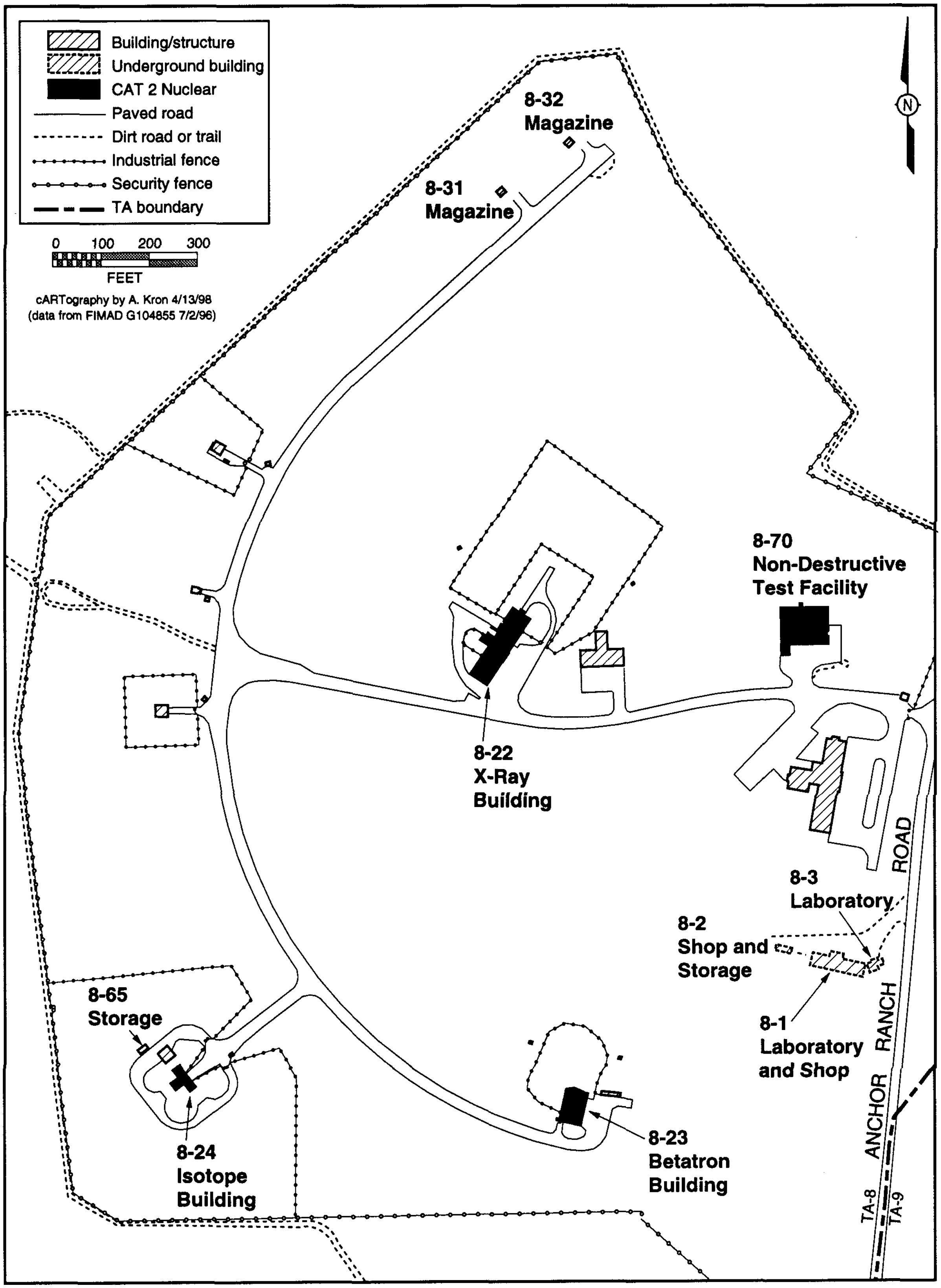
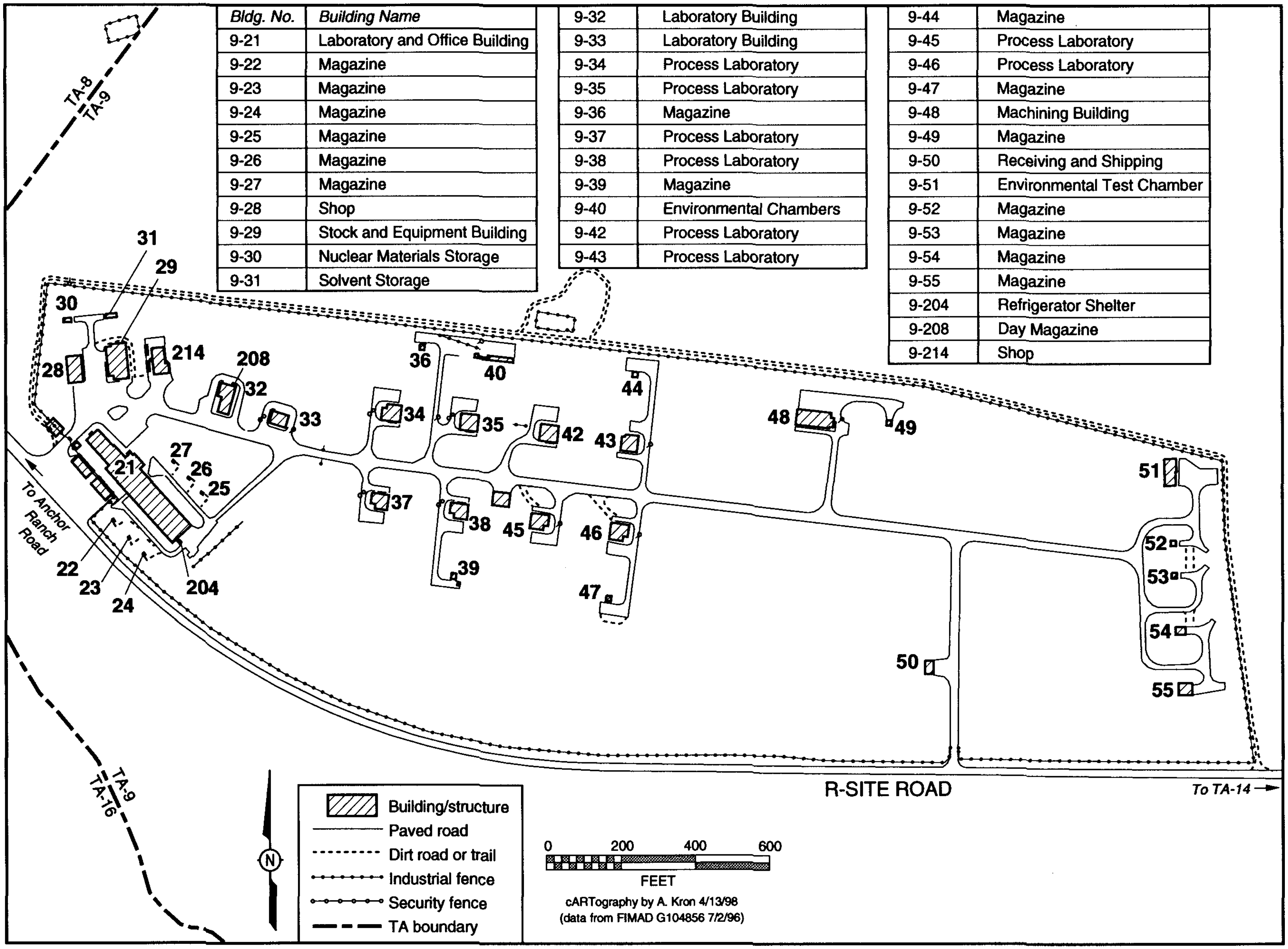


FIGURE 2.2.2.9–1.—*TA–8 High Explosives Processing.*



Bldg. No.	Building Name
9-21	Laboratory and Office Building
9-22	Magazine
9-23	Magazine
9-24	Magazine
9-25	Magazine
9-26	Magazine
9-27	Magazine
9-28	Shop
9-29	Stock and Equipment Building
9-30	Nuclear Materials Storage
9-31	Solvent Storage
9-32	Laboratory Building
9-33	Laboratory Building
9-34	Process Laboratory
9-35	Process Laboratory
9-36	Magazine
9-37	Process Laboratory
9-38	Process Laboratory
9-39	Magazine
9-40	Environmental Chambers
9-42	Process Laboratory
9-43	Process Laboratory
9-44	Magazine
9-45	Process Laboratory
9-46	Process Laboratory
9-47	Magazine
9-48	Machining Building
9-49	Magazine
9-50	Receiving and Shipping
9-51	Environmental Test Chamber
9-52	Magazine
9-53	Magazine
9-54	Magazine
9-55	Magazine
9-204	Refrigerator Shelter
9-208	Day Magazine
9-214	Shop

FIGURE 2.2.2.9–2.—*TA–9 High Explosives Processing.*

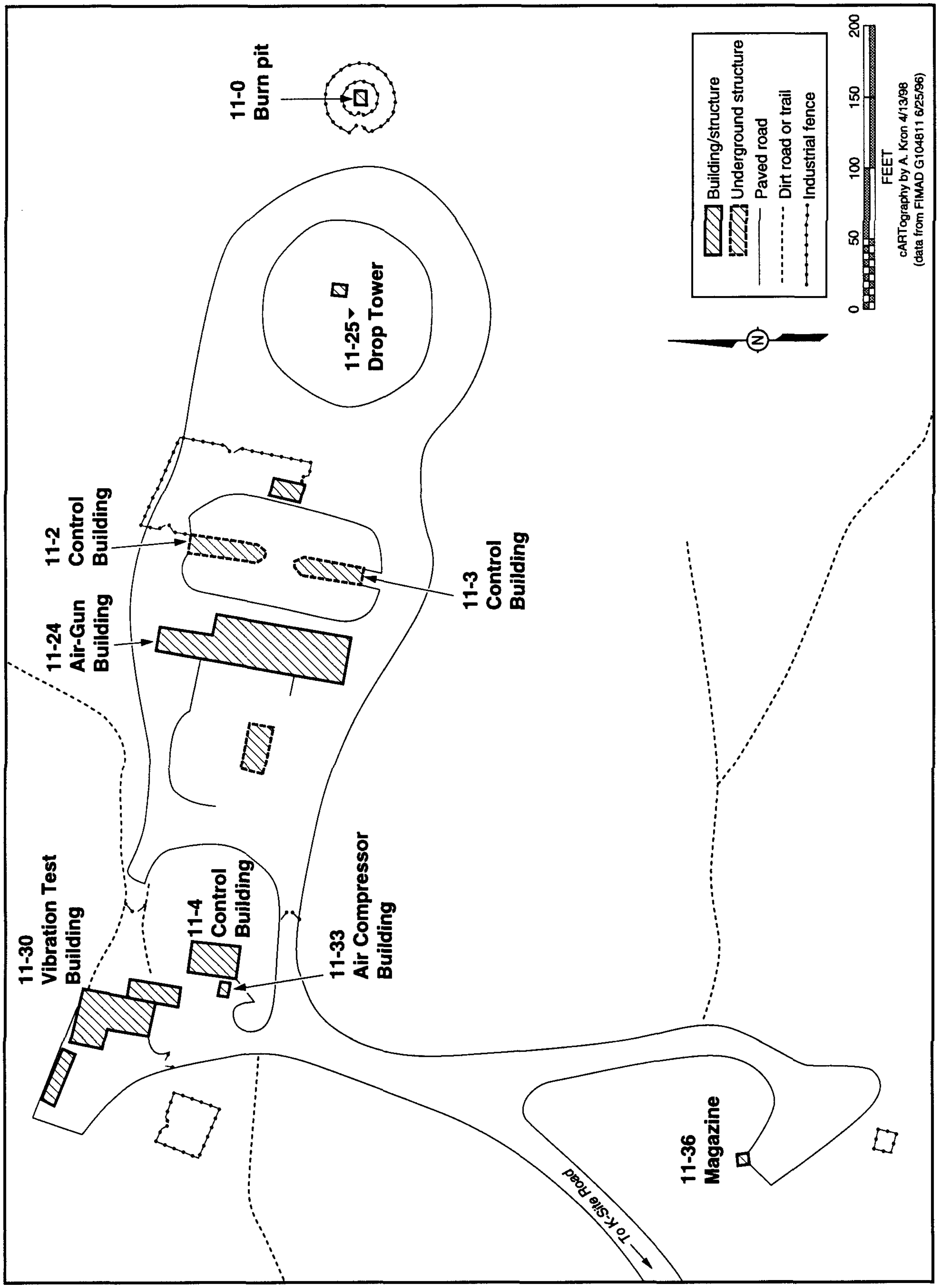


FIGURE 2.2.2.9–3.—*TA–11 High Explosives Processing.*

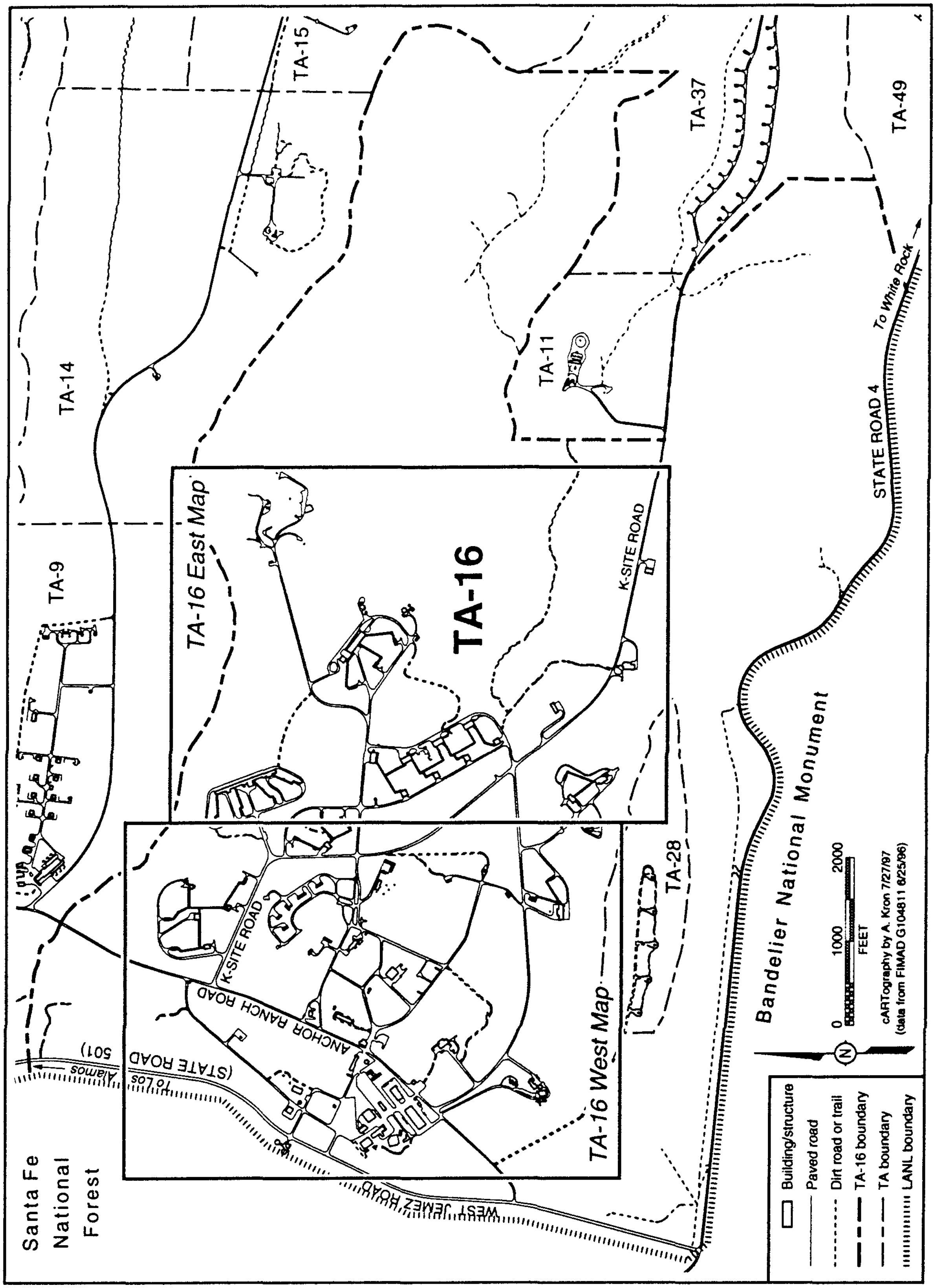
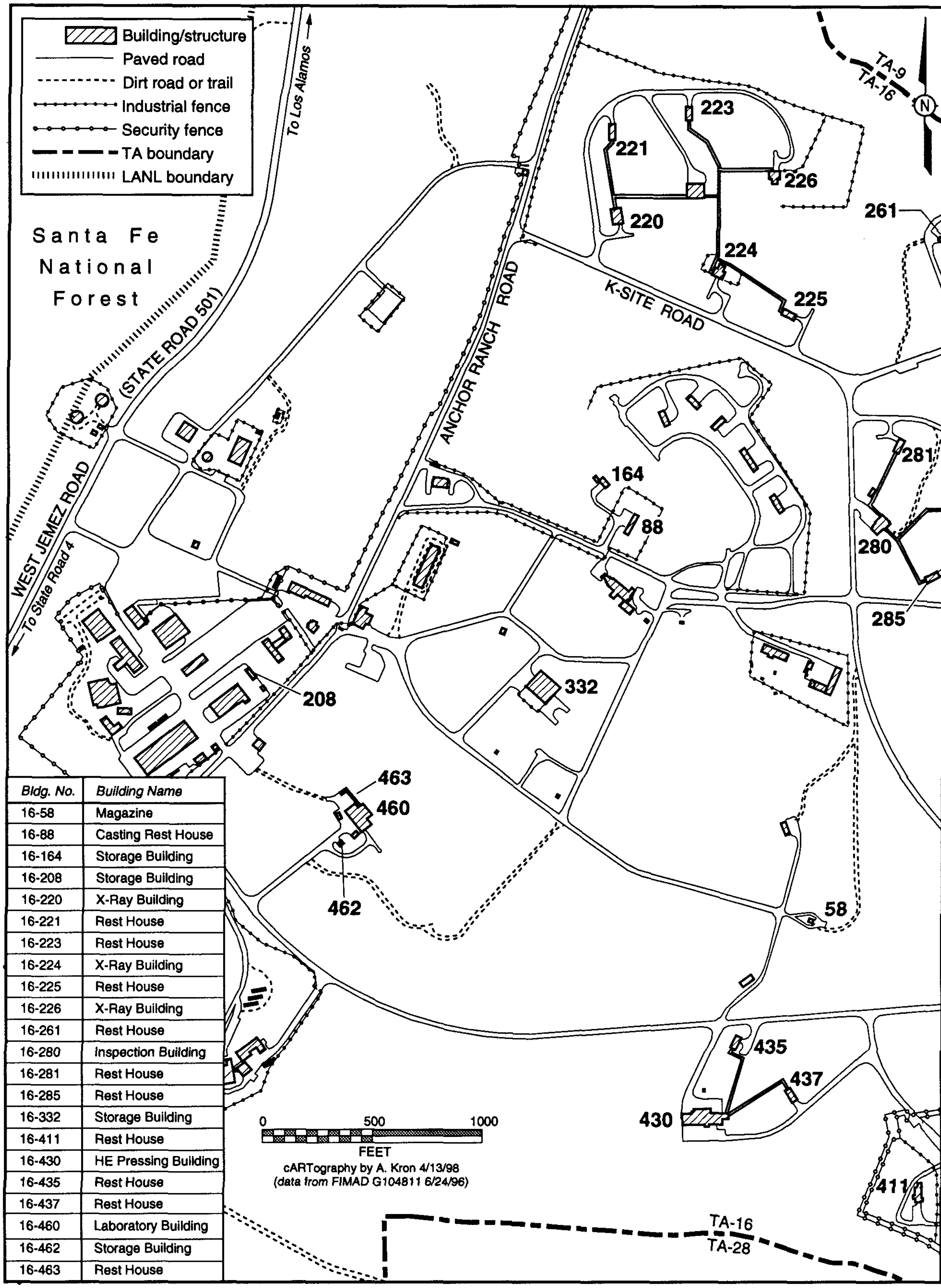
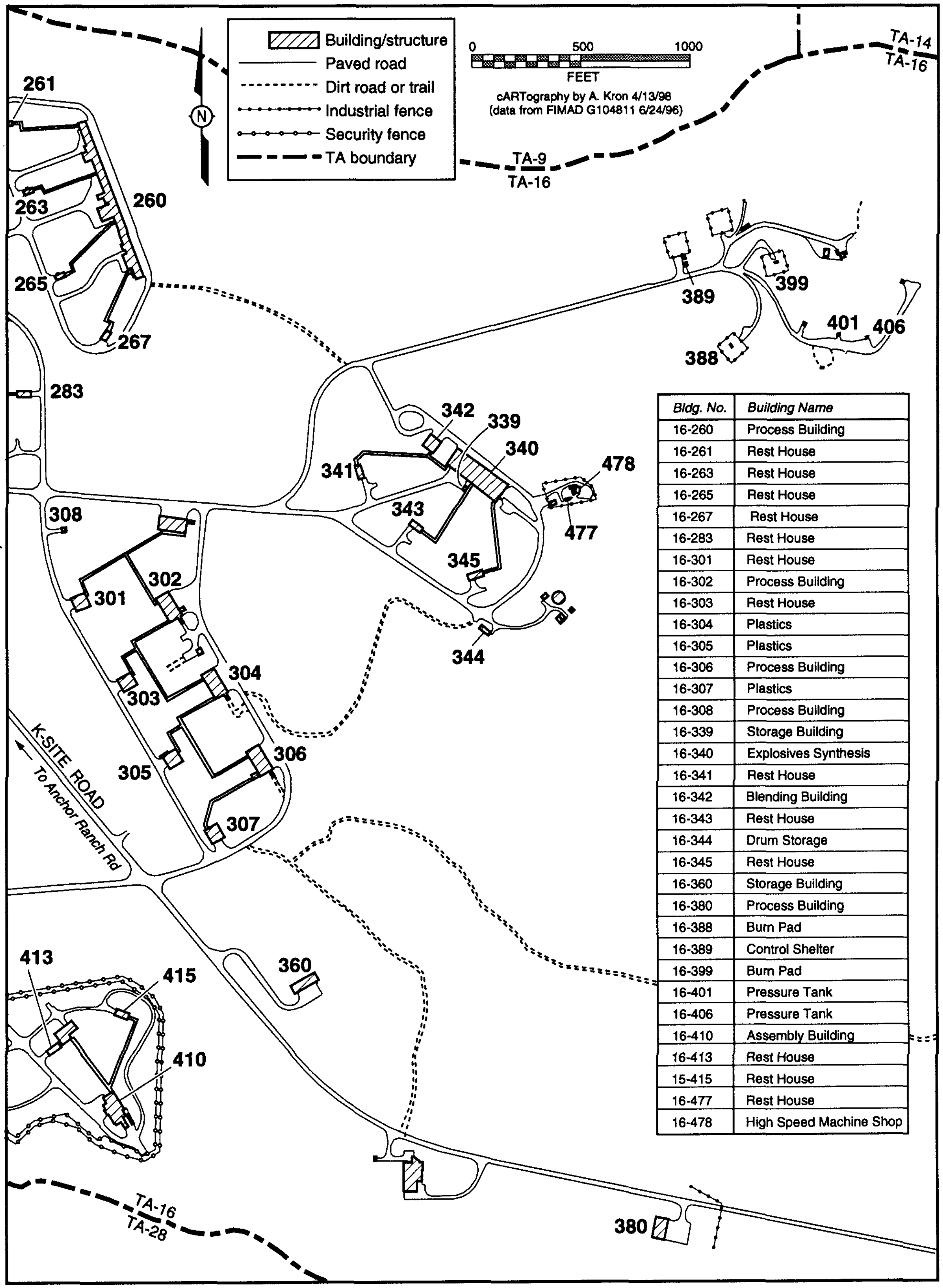


FIGURE 2.2.2.9–4.—*TA–16 High Explosives Processing.*



Bldg. No.	Building Name
16-58	Magazine
16-88	Casting Rest House
16-164	Storage Building
16-208	Storage Building
16-220	X-Ray Building
16-221	Rest House
16-223	Rest House
16-224	X-Ray Building
16-225	Rest House
16-226	X-Ray Building
16-261	Rest House
16-280	Inspection Building
16-281	Rest House
16-285	Rest House
16-332	Storage Building
16-411	Rest House
16-430	HE Pressing Building
16-435	Rest House
16-437	Rest House
16-460	Laboratory Building
16-462	Storage Building
16-463	Rest House

FIGURE 2.2.2.9–5.—*TA–16 West High Explosives Processing.*



Bldg. No.	Building Name
16-260	Process Building
16-261	Rest House
16-263	Rest House
16-265	Rest House
16-267	Rest House
16-283	Rest House
16-301	Rest House
16-302	Process Building
16-303	Rest House
16-304	Plastics
16-305	Plastics
16-306	Process Building
16-307	Plastics
16-308	Process Building
16-339	Storage Building
16-340	Explosives Synthesis
16-341	Rest House
16-342	Blending Building
16-343	Rest House
16-344	Drum Storage
16-345	Rest House
16-360	Storage Building
16-380	Process Building
16-388	Burn Pad
16-389	Control Shelter
16-399	Burn Pad
16-401	Pressure Tank
16-406	Pressure Tank
16-410	Assembly Building
16-413	Rest House
15-415	Rest House
16-477	Rest House
16-478	High Speed Machine Shop

FIGURE 2.2.2.9–6.—*TA–16 East High Explosives Processing.*

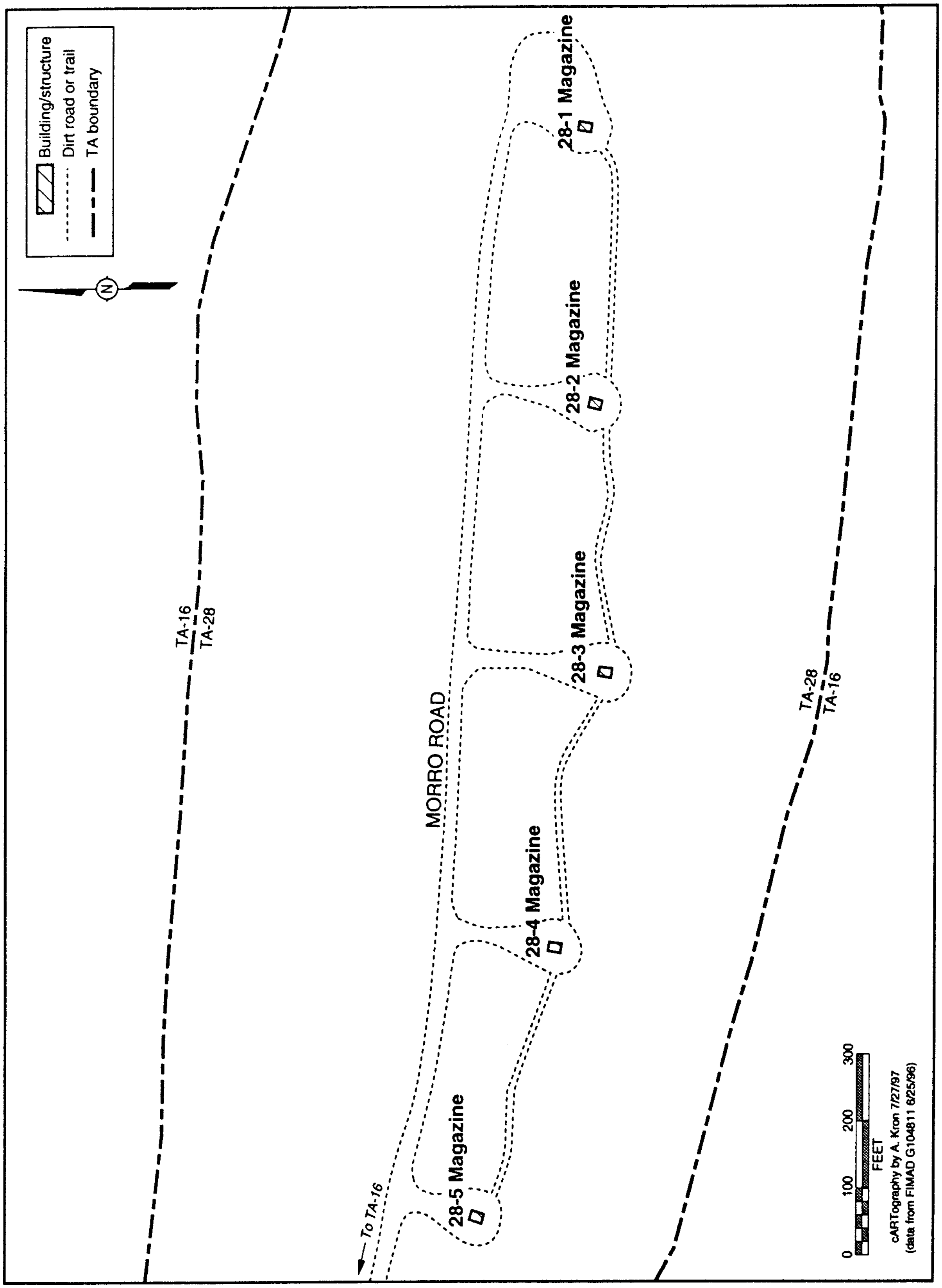


FIGURE 2.2.2.9–7.—*TA–28 High Explosives Processing.*

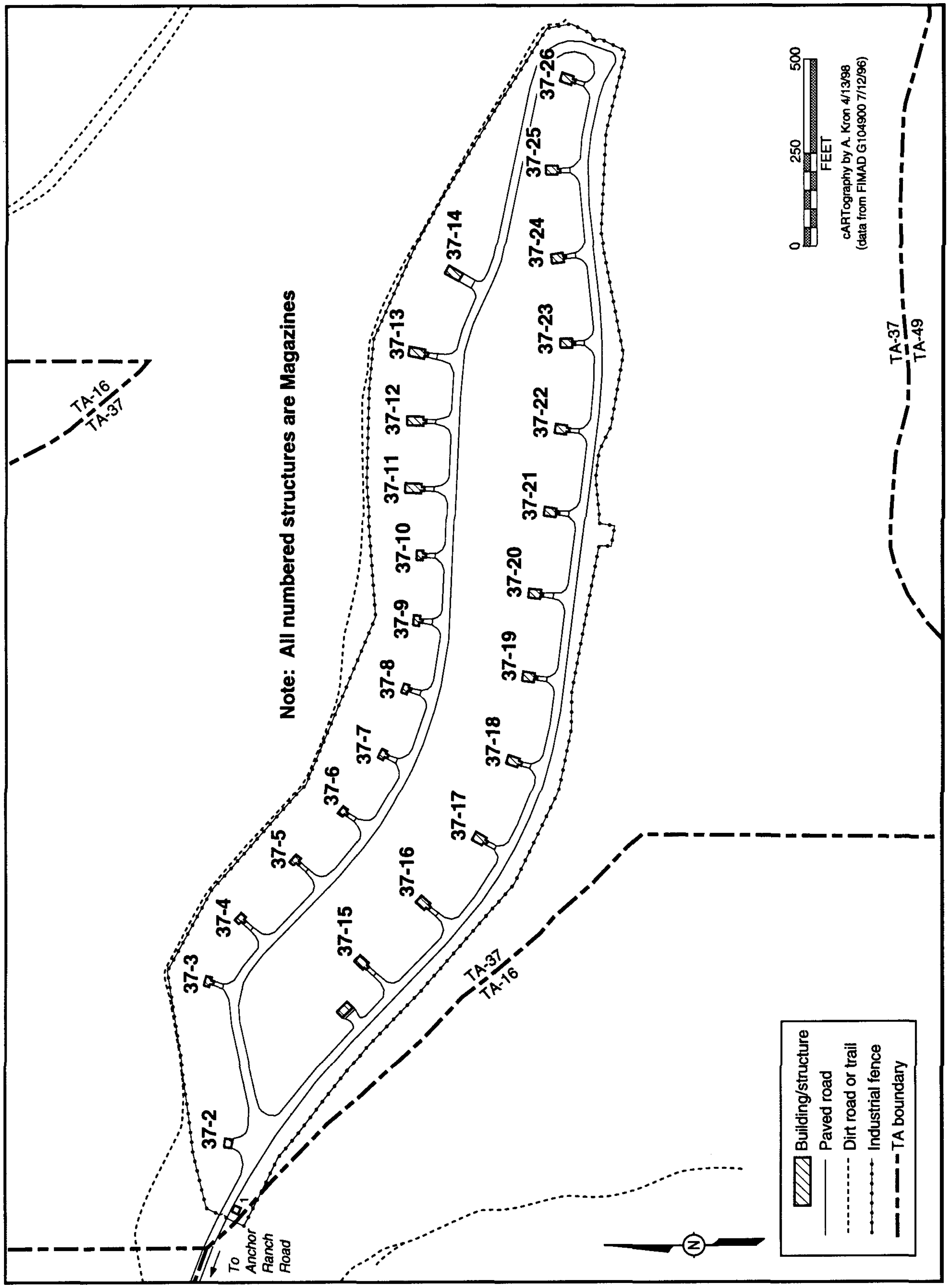


FIGURE 2.2.2.9–8.— *TA–37 High Explosives Processing.*

TABLE 2.2.2.9–1.—*High Explosives Processing Facilities: Identification of Principal Buildings/Structures*

TECHNICAL AREA	PRINCIPAL BUILDINGS AND STRUCTURES
TA–8	Nondestructive Testing/Radiography: 8–22, 23, 24, 70 Storage, Radiography Sources: 8–65
TA–9	Offices, Laboratories: 9–21, 32, 33, 34, 35, 37, 38, 42, 43, 45, 46 Service Magazines: 9–22, 23, 24, 25, 26, 27, 208 Shop Buildings: 9–28, 214 Nuclear Materials Storage: 9–30 Solvent Storage: 9–31 Magazines: 9–36, 39, 44, 47, 49, 52, 53, 54, 55, 204 Thermal Cycle Facility: 9–40 HE Machining Building: 9–48 Receiving and Shipping Building: 9–50 Detonator Storage: 9–51
TA–11	Control Buildings: 11–2, 3, 4 Air Gun Building: 11–24 Drop Tower: 11–25 Vibration Test Building: 11–30 Air Compressor Building: 11–33 Magazine: 11–36 Weapon Burn Test Facility: 11–0
TA–16	Instrumentation, Testing: 16–54 Magazine: 16–58 Storage Buildings: 16–164, 208, 332 Dark Room: 16–222 Process Buildings: 16–260, 306 Rest Houses (HE Magazines): 16–261, 263, 267 HE Assembly/Rest House: 16–265 Inspection Building: 16–280 Rest House/HE Shipping: 16–281 Rest House/Museum: 16–283 Rest House/HE Receiving: 16–285 Mock Explosives Prep (being vacated): 16–300 Rest House/HE Environmental Testing: 16–301 Process Building (being vacated): 16–302 Rest House (being vacated): 16–303 Plastics Buildings: 16–304, 305, 307 Solvent Storage: 16–339 Explosives Process Building: 16–340 Rest Houses: 16–341, 345, 411, 413, 415, 435, 437
TA–22	Detonation Systems Laboratory 22-90, 91, 93 Solvent Storage Shed 22-95 HE Storage Building 22-66, 67, 68, 69 Advanced Development Laboratory 22-34 HE Process Building 22-8 Magazines 22-7, 22–15, 16, 17, 18, 19, 20, 21, 22, 23
TA–28	Magazines, Protective Force: 28–1, 2, 3 Magazine, Explosives: 28–4 Magazine: 28–5
TA–37	Standard HE Magazines: 37–2 through 26

(26,013 square meters) of space support formulation, casting, pressing, machining, assembly, and a range of quality assurance operations. In addition, two beryllium operations are performed at TA–16. TA–11 comprises 12 buildings with 9,300 square feet (864 square meters) in which various environmental and safety tests are performed. The four principal buildings at TA–22, known as Los Alamos Detonator Facility (LADF), contain 50,000 square feet (4,650 square meters) supporting fabrication, testing, and surveillance of explosive detonation systems. In addition, LADF provides DOE-wide support for packaging and transportation of electro-explosive devices. TA–28 and TA–37 are magazine storage areas. The HE facilities at TA–8 occupy buildings with 14,500 square feet (1,347 square meters) in which nondestructive testing operations are performed.

All existing HE fabrication structures meet current applicable earthquake standards. Structures containing HE and those in which HE operations are conducted are constructed with 2-foot (0.6-meter) thick, steel-reinforced concrete walls designed to mitigate the effects of an accidental explosion. Most facilities include support areas for offices; break rooms; restrooms; electrical equipment; heating, ventilation, and air conditioning equipment; maintenance; and in-process staging for materials, components, tooling, and supplies.

TA–16 is categorized as a moderate hazard facility because of the presence of chlorine and a tritium facility. (WETF, described in section 2.2.2.2, is a separate "key" facility but is in the same TA as some of the HE processing facilities described here.) Two projects related to HE operations during the next 5 to 10 years were analyzed in the *Relocation of the Weapons Components Testing Facility Environmental Assessment* (DOE 1995b) and in the *Environmental Assessment, High Explosive Wastewater Treatment Facility* (DOE 1995d) (operational in October 1997). Another project is the TA–16 Steam Plant Conversion, a maintenance and refurbishment project that was completed and operational in September 1996.

Several permitted outfalls exist at TA–8, TA–9, TA–11, and TA–16. These outfalls are slated for modification as stated in the *Effluent Reduction Environmental Assessment* (DOE 1996c). Six of the outfalls will be eliminated completely, four outfalls are slated for waste stream consolidation, two outfalls are slated for outfall reduction, and one will decrease discharge rates as stated in the HE Wastewater Treatment Facility EA, and four will be decontaminated, but will continue to discharge. The disposition of the remaining outfalls will not change.

The HE processing facilities include support infrastructure for shipping, receiving, storage, packaging, and transportation. All receiving activities are conducted at TA–16, with storage at TA–28 and TA–37.

These facilities also include disposal facilities that are permitted by the State of New Mexico for disposal of HE waste and HE contaminated materials. A large flash pad is used to thermally remove HE contamination from other materials prior to burial. Two aboveground burning trays are used to destroy HE scrap and residue. Two sand filters remove water from sump sludge for drying and burning. One aboveground tray burns oil contaminated with HE. An incinerator is available for disposal of trash from the HE areas; such trash is presumed to be contaminated with HE due to association with HE processes. All water is filtered for HE and treated with activated carbon for solvent removal. Chemical oxygen demand, suspended solids, and acidity (pH) are measured prior to authorizing release to the environment. Non-HE hazardous wastes and LLW are trucked to the LANL waste management facilities.

Description of Capabilities

The major HE processing activities and their principal locations are described below. The manner in which these activities would vary among the alternatives is described in chapter 3.

High Explosives Synthesis and Production. These activities include explosive-manufacturing capabilities such as synthesizing new explosives and manufacturing pilot-plant quantities of raw explosives and plastic-bonded explosives. These operations allow LANL to develop and maintain expertise in explosive materials and processes that are essential for long-term maintenance of stockpile weapons and materials. Most of the HE synthesis and small-scale production activities are conducted at TA–9. War Reserve detonator testing and production is conducted at TA–22, as discussed below under Research, Development, and Fabrication of High-Power Detonators.

High Explosives and Plastics Development and Characterization. These activities provide characterization data for any explosives application in nuclear weapons technology. Information on initiation and detonation properties of HE coupled with non-HE component information for modeling is essential to the design and safety analysis of a weapon. These activities are conducted at TA–9 and TA–40. A wide range of plastic and composite materials are used in nuclear weapons such as adhesives, potting materials, flexible cushions and pads, thermoplastics and elastomers. It is also necessary to have a thorough understanding of the chemical and physical properties of these materials to model weapons behavior. Most of the materials characterization work is conducted at TA–9, TA–16, and TA–40.

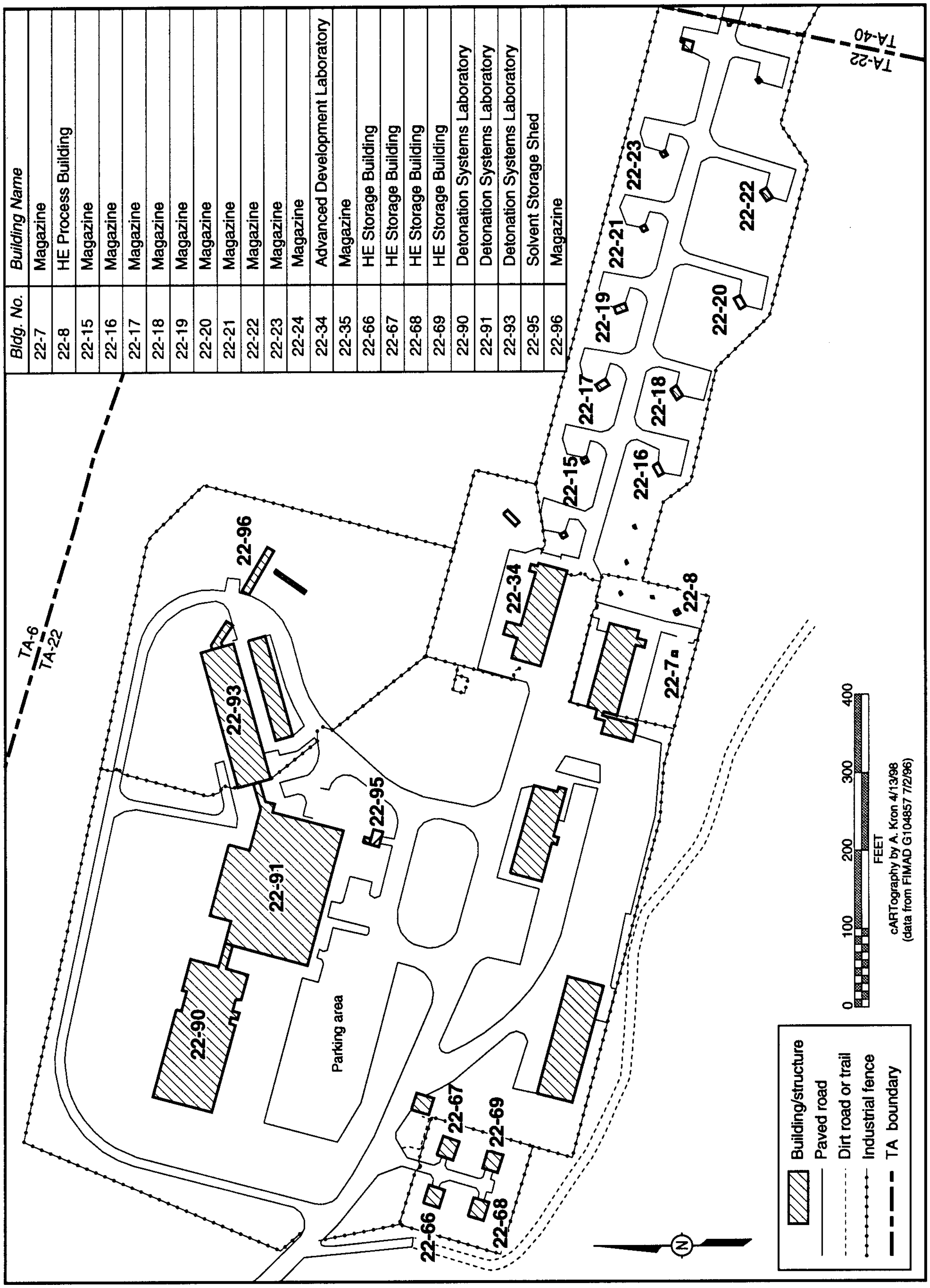
High Explosives and Plastics Fabrication. HE powders are typically compacted into solid pieces and machined to final specified shapes. Some small pieces are pressed into final shapes, and some powders, based upon their properties, are melted into stock pieces. Fabrication of plastic materials and components is a core capability associated with HE processing. Efforts are focused on weapons needs, but a wide variety of plastic and composite materials may be fabricated. Most of the HE and plastics fabrication is performed at TA–9 and TA–16.

Test Device Assembly. Test devices are assembled, ranging from full-scale nuclear explosive-like assemblies (where fissile material has been replaced by inert material) to material characterization tests. Assembly operations for the largest test devices are performed in TA–16. Smaller test assemblies may be prepared at the explosives testing support facilities at TA–9, TA–22, and TA–40. Radiography examinations of the final assembly are done at TA–8.

Safety and Mechanical Testing. Capabilities exist for measuring mechanical properties of explosives samples, including tensile, compression, and creep properties (i.e., change of materials shapes over time). Test assemblies can be instrumented with strain gages, pressure gages, or other diagnostic equipment. Safety testing, such as HE handling tests, drop tests, and impact tests, are used to evaluate abnormal conditions. Accelerated aging tests are conducted at TA–9. Most safety, mechanical, and environmental testing is conducted in laboratory and test buildings at TA–9, TA–11, and TA–16.

Research Development and Fabrication of High-Power Detonators. Capabilities at TA–22 include detonator design; printed circuit manufacture; metal deposition and joining; plastic materials technology; explosives loading, initiation, and diagnostics; lasers; and safety of explosives systems design, development, and manufacture. Detonators, cables, and firing systems for tests are built in this program. This also includes support to the DOE complex for packaging and transportation of electro-explosive devices.

The LADF (Figure 2.2.2.9–9) (Buildings 90, 91, 93, and 34) houses the research, development, and fabrication capabilities for detonation systems. This facility consists of three



Bldg. No.	*Building Name*
22-7	Magazine
22-8	HE Process Building
22-15	Magazine
22-16	Magazine
22-17	Magazine
22-18	Magazine
22-19	Magazine
22-20	Magazine
22-21	Magazine
22-22	Magazine
22-23	Magazine
22-24	Magazine
22-34	Advanced Development Laboratory
22-35	Magazine
22-66	HE Storage Building
22-67	HE Storage Building
22-68	HE Storage Building
22-69	HE Storage Building
22-90	Detonation Systems Laboratory
22-91	Detonation Systems Laboratory
22-93	Detonation Systems Laboratory
22-95	Solvent Storage Shed
22-96	Magazine

FIGURE 2.2.2.9-9.—*TA-22 Los Alamos Detonator Facility.*

connected buildings, one of which, Building 90, is an office wing connected to Building 91 by a corridor. Building 91 is designated as the inert half of the facility, meaning there are no high explosives processed there. The printed circuit manufacturing, cable fabrication, and electronics work is done in this facility.

In Buildings 93 and 34, bulk explosive powder is formed into detonator subassemblies and incorporated into final assemblies that are then measured, inspected, and prepared for storage or test firing. The area around the HE building (93 and 34) is enclosed by a fence with a locked gate, and access to the building is limited to authorized personnel. Small-scale testing activities are also performed in Building 34.

A facility may be constructed in the future as a separate detonator production facility. This action, which was analyzed in the Nonnuclear Consolidation EA (DOE 1993), was delayed from its original schedule; it is currently uncertain when this action might be undertaken.

2.2.2.10 *High Explosives Testing: TA–14 (Q-Site), TA–15 (R-Site), TA–36 (Kappa-Site), TA–39 (Ancho Canyon Site), and TA–40 (DF-Site)*

The facilities that make up the explosives testing operations are used primarily for research, development, test operations, and detonator development and testing related to DOE's stockpile stewardship and management programs (Figures 2.2.2.10–1 through 2.2.2.10–7). The firing sites specialize in experimental studies of the dynamic properties of materials under conditions of high pressure and temperature. The firing site facilities, occupying approximately 22 square miles (57 square kilometers) of land area, represent at least half of the total land area occupied by LANL (see Table 2.2.2.10–1).

Various radioactive and nonradioactive materials are used in the firing sites operations. Depleted uranium and plutonium metal are used in some of the operations (plutonium in such operations is contained to prevent release). Nonradioactive toxic or hazardous materials may include beryllium, copper, aluminum, and heavy metals. Other materials used are solvents such as acetone, chlorinated hydrocarbons, toluene, xylene, or 1,1,1–trichloroethane. Sulfur hexafluoride is used as an insulating gas in specialized high-voltage equipment.

There are 13 permitted NPDES outfalls located at the firing site operations. DOE plans to eliminate one of these outfalls as described in the *Environmental Assessment for Effluent Reduction* (DOE 1996c).

An ongoing construction project related to the TA–15 firing site operations is the Dual Axis Radiographic Hydrodynamic Test (DARHT) Facility, analyzed in the *Dual Axis Radiographic Hydrodynamic Test Facility Final Environmental Impact Statement* (DOE 1995c). The first axis for this facility is currently being installed and is expected to be operational by the end of 1999. The second axis is expected to be operational by the end of 2002.

Description of Facilities

HE testing activities are conducted in five TAs, having a total of 13 associated firing sites. (This number can change slightly over time.) All of the firing areas are located in remote locations on the Pajarito Plateau or within canyons of the plateau. Four of the areas are located on or just below Threemile Mesa. The nearest private residences to these four firing areas are in the Royal Crest Trailer Park north of Sandia Canyon located approximately 2 miles (3.2 kilometers) to the north, and White Rock, approximately 4 to 6 miles (6.4 to 9.7 kilometers) to the southeast. The following paragraphs contain descriptions of the five firing areas.

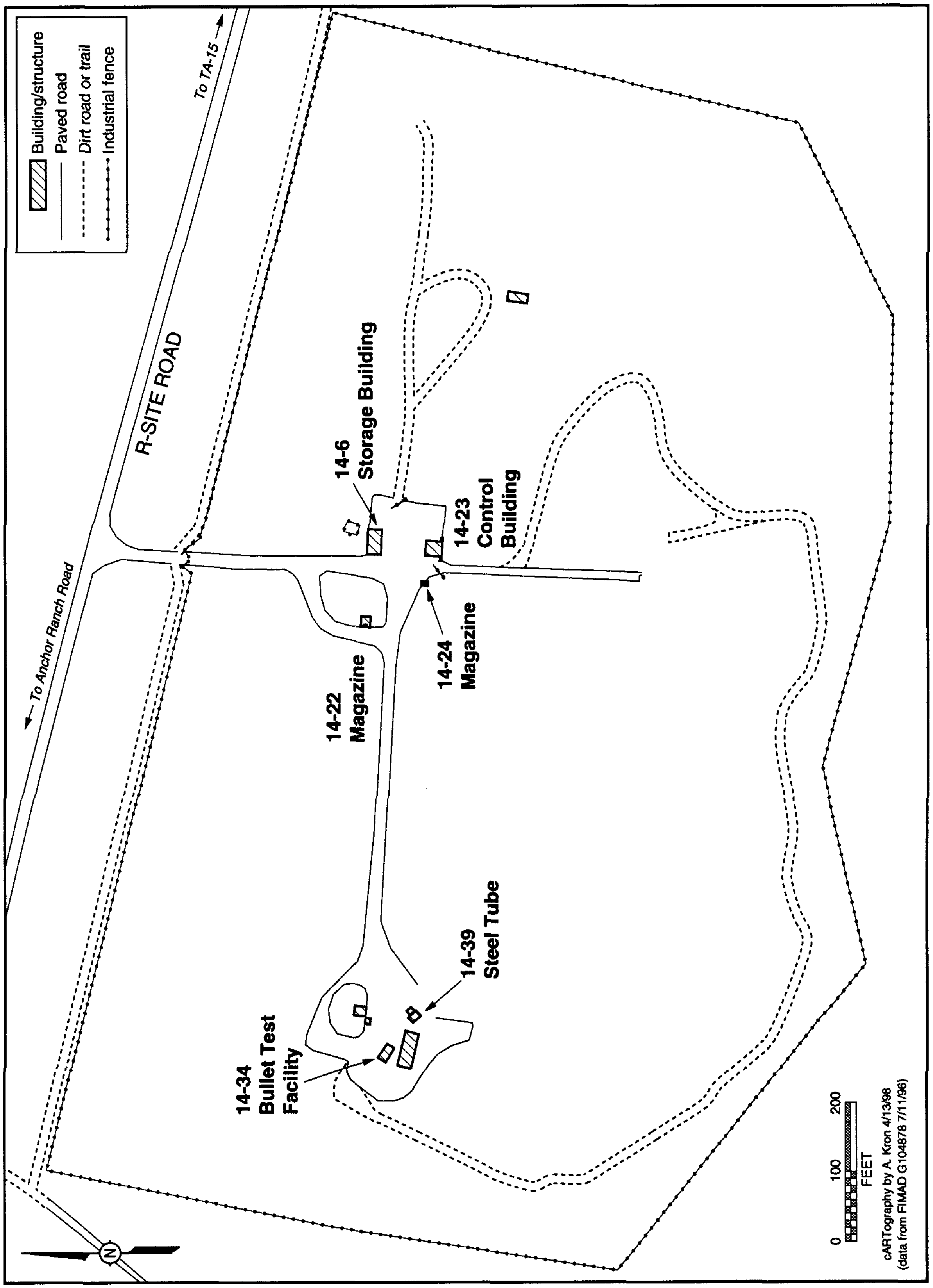


FIGURE 2.2.2.10–1.—*TA–14 High Explosives Testing.*

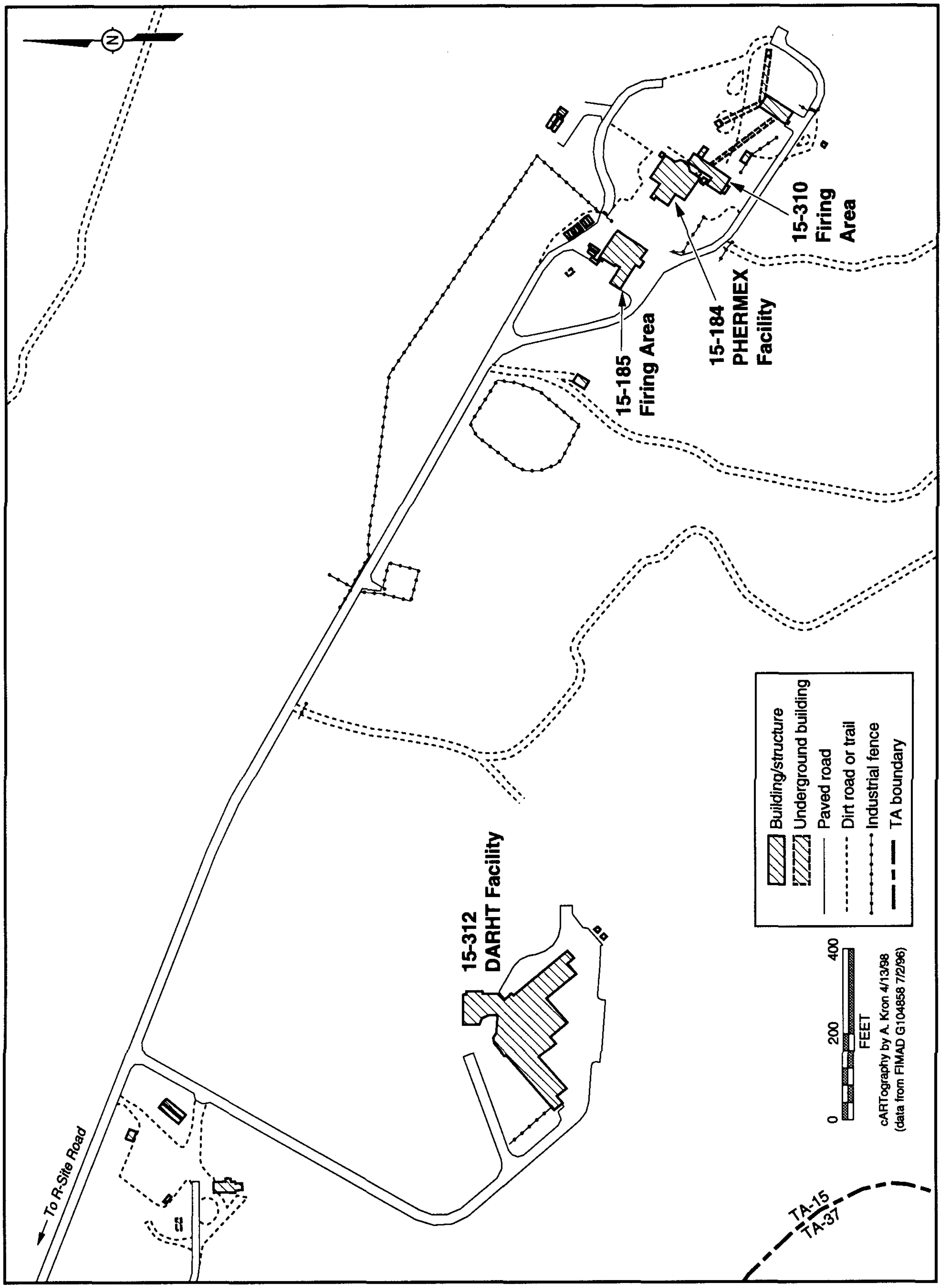


FIGURE 2.2.2.10–2.—*TA–15 West High Explosives Testing.*

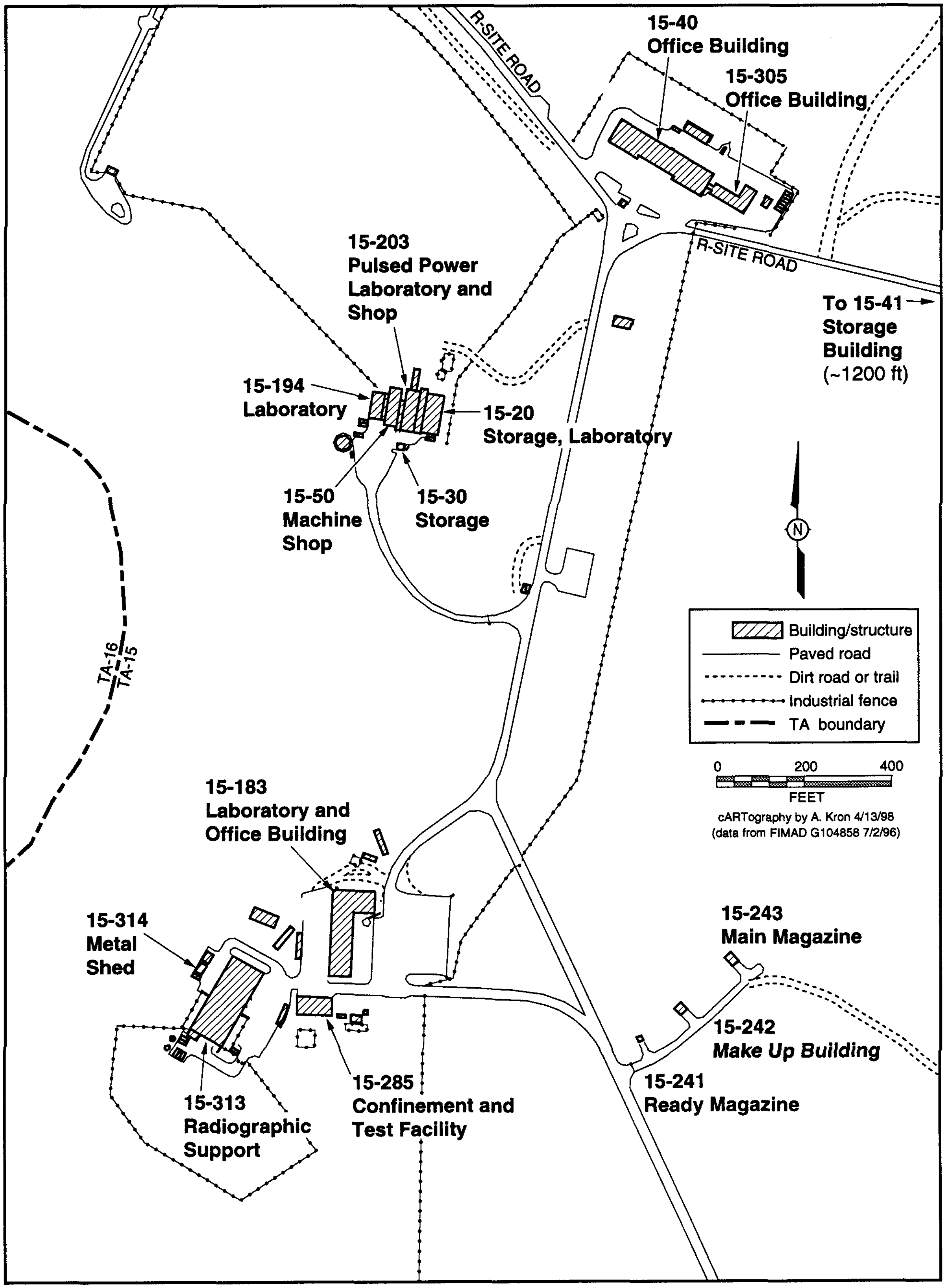


FIGURE 2.2.2.10–3.—*TA–15 Central High Explosives Testing.*

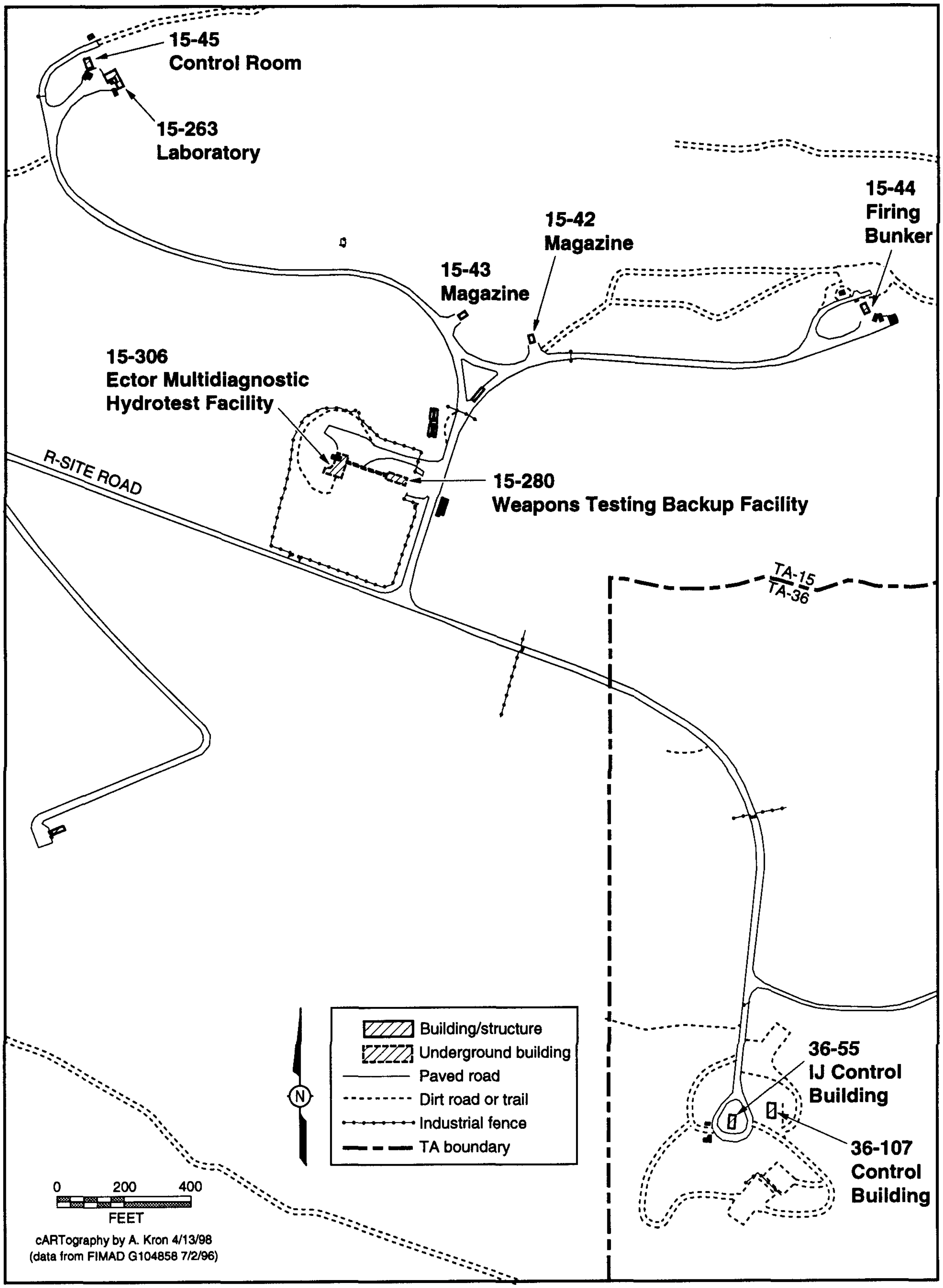


FIGURE 2.2.2.10–4.—*TA–15 East and TA–36 West High Explosives Testing.*

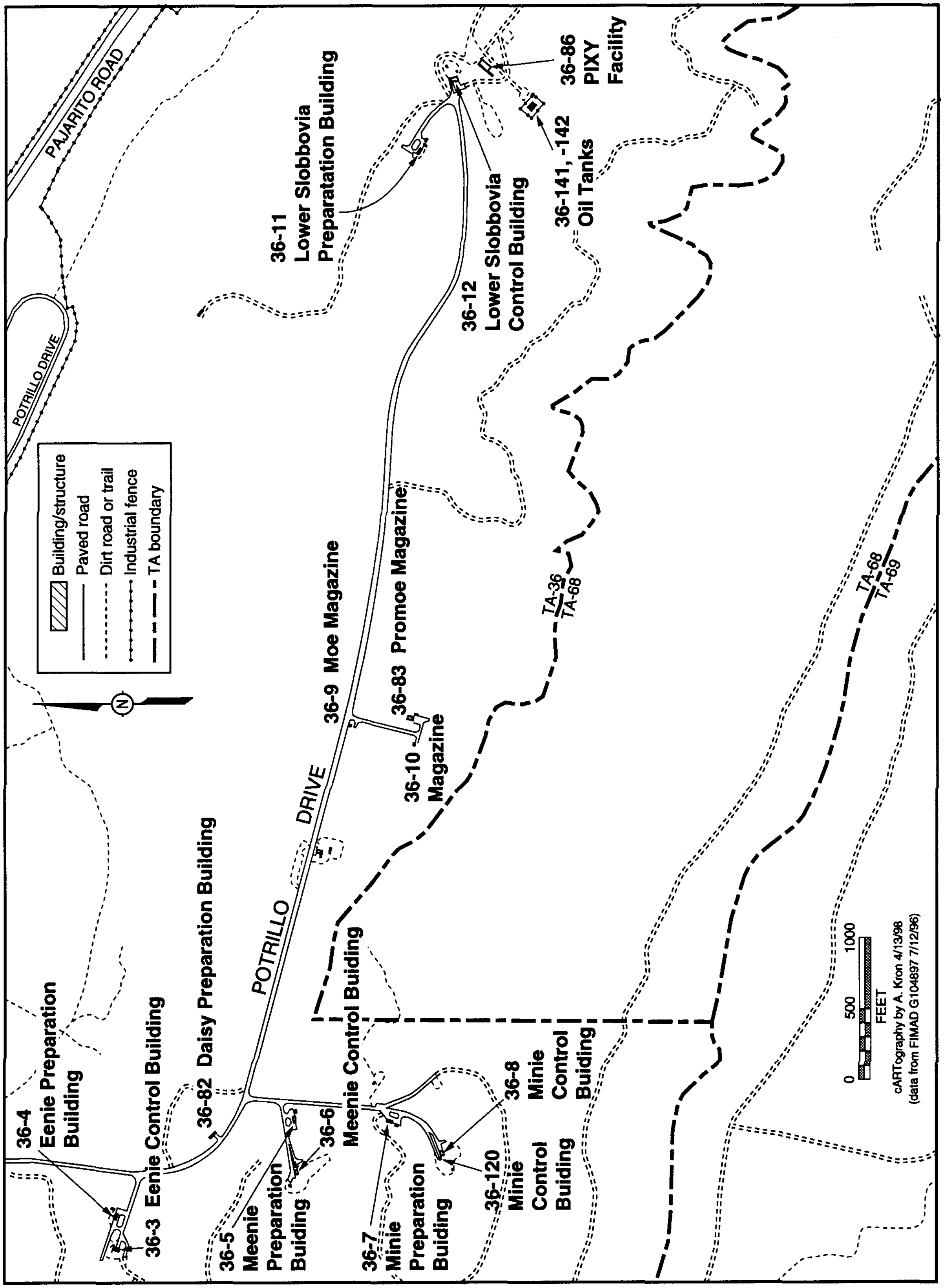


FIGURE 2.2.2.10–5.—*TA–36 East High Explosives Testing.*

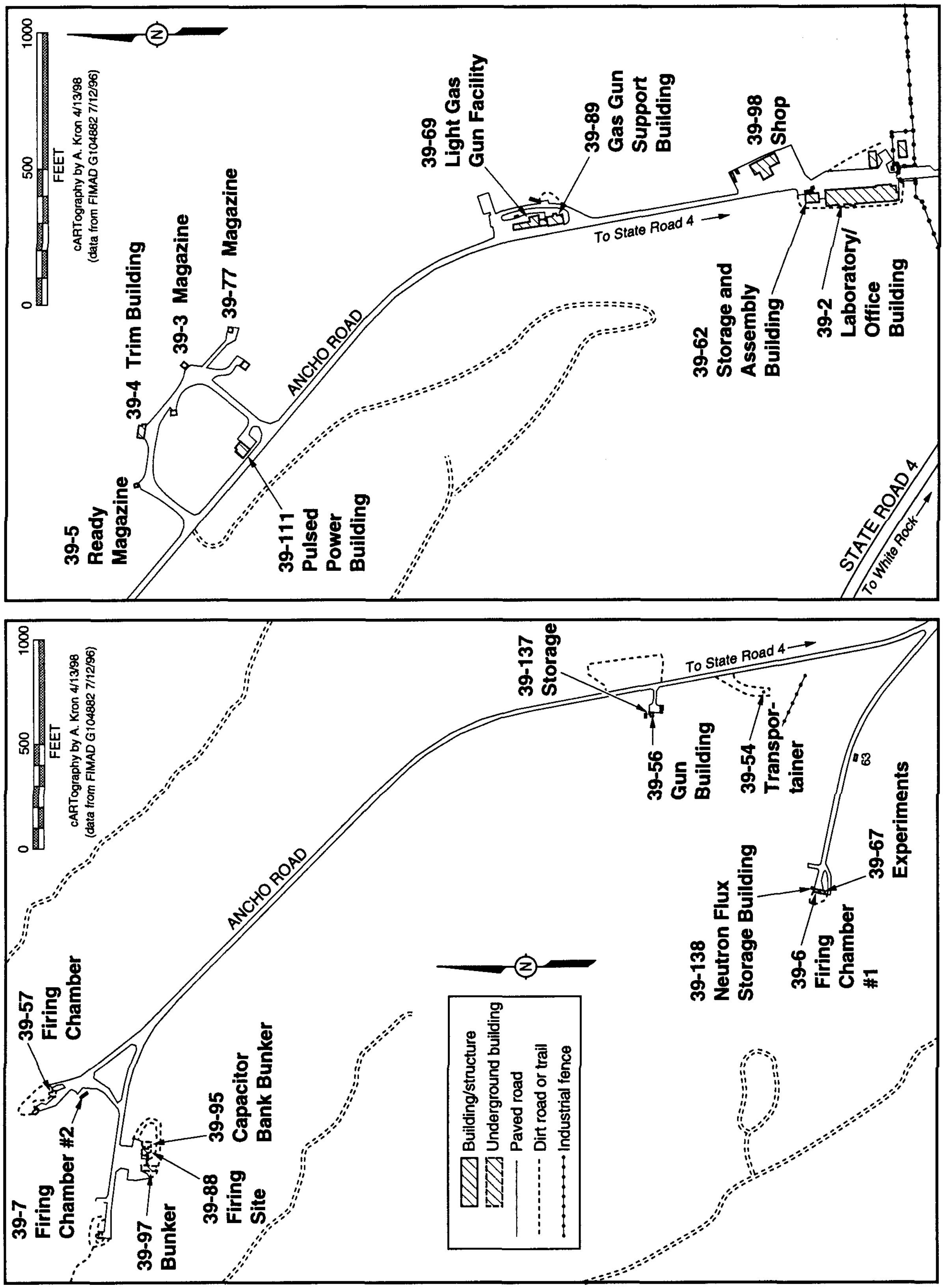
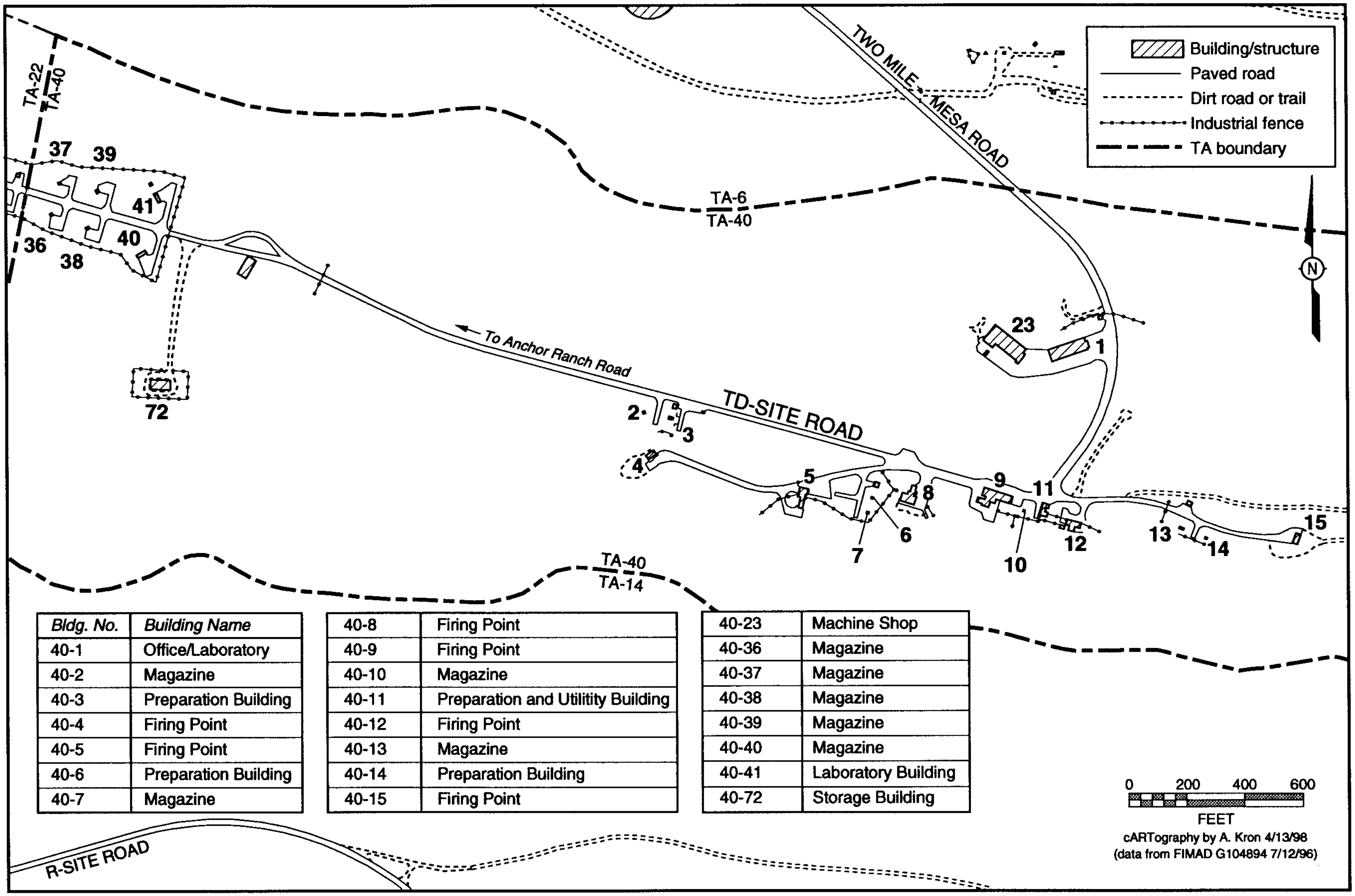


FIGURE 2.2.2.10–6.—*TA–39 High Explosives Testing.*



Bldg. No.	*Building Name*				
40-1	Office/Laboratory	40-8	Firing Point	40-23	Machine Shop
40-2	Magazine	40-9	Firing Point	40-36	Magazine
40-3	Preparation Building	40-10	Magazine	40-37	Magazine
40-4	Firing Point	40-11	Preparation and Utilitiy Building	40-38	Magazine
40-5	Firing Point	40-12	Firing Point	40-39	Magazine
40-6	Preparation Building	40-13	Magazine	40-40	Magazine
40-7	Magazine	40-14	Preparation Building	40-41	Laboratory Building
		40-15	Firing Point	40-72	Storage Building

FIGURE 2.2.2.10–7.—*TA–40 East High Explosives Testing.*

TABLE 2.2.2.10–1.—*Principal Buildings and Structures of High Explosives Testing Facilities*

TECHNICAL AREAS	PRINCIPAL BUILDINGS AND STRUCTURES
TA–14 (Q-Site)	Warehouse: 14–6 Magazines: 14–22, 24 Control Room, Make-Up Room, Laboratory: 14–23
TA–15 (R-Site)	Firing Areas: 15–184, 185, 310 Weapons Testing Backup Facilities: 15–280 Ector Multidiagnostic Hydrotest Facility: 15–306 Firing Bunker: 15–44 Control Room: 15–45 Weapons Storage and Preparation: 15–41 Magazines: 15–42, 43, 241, 243 Make-Up Building, Short-Term Storage: 15–242 Storage, Laboratory: 15–20 Machine Shop: 15–50 Laboratory: 15–194 Storage: 15–30 Pulsed-Power Laboratory and Shop: 15–203 Offices Buildings: 15–40, 183, 305
TA–36 (Kappa-Site)	Offices, Laboratories: 36–1, 48, 84 Control Buildings: 36–3, 6, 8, 12, 107, 120 Preparation Buildings: 36–4, 5, 7, 11, 82 Magazines: 36–9, 10, 83 Firing Box: 36–21 Pixy Facility: 36–86 Oil Tanks: 36–141, 142
TA–39 (Ancho Canyon Site)	Main Office, Laboratories, Shops: 39–2 Magazines: 39–3, 5, 77 Trim Building: 39–4 Firing Sites: 39–6, 57, 88 Gas Gun Facility: 39–56 Storage and Assembly Building: 39–62 Gun Room, Instrument Room: 39–69 Gas Gun Support Building: 39–89 Shop: 39–98 Pulsed-Power Building: 39–111 Storage: 39–137, 138 Bunkers: 39–56, 95, 97 Experiments: 39–67
TA–40 (DF-Site)	Offices, Laboratories: 40–1 Machine Shops: 40–23 Gas Gun Facility: 40–9 Firing Sites: 40–4, 5, 8, 9, 15 Preparation Rooms: 40–3, 6, 11, 12, 14 Magazines: 40–2, 7, 10, 13, 36, 37, 38, 39, 40 Laboratory Building: 40–41

The major use of the TA–14, Q-Site, firing area is testing quantities of energetic materials (such as HE) that exceed the safety limits for these materials indoors at TA–9. Two firing sites are available at the Q-Site firing area. Up to 100 pounds (45.4 kilograms) of HE per test may be fired at this area. Characterization tests to determine the chemical and physical properties of energetic materials used to model weapons behavior are conducted at this site. DOE has applied for a RCRA permit for the disposal of explosives and explosives-contaminated materials at Q-Site by either detonation or by burning. Currently, waste disposal is performed under RCRA interim status requirements by either detonation or by burning.

TA–15, R-Site, contains three firing sites: Pulsed High-Energy Radiation Machine Emitting X-Rays (PHERMEX) facility, DARHT Facility, and R306, a general purpose firing site. The PHERMEX facility is capable of producing high-resolution x-ray pictures of very dense, fast-moving materials and is used primarily for weapons studies. The PHERMEX firing site is used for full-scale, multidiagnostic hydrodynamic tests and for smaller scale experiments, such as the study of HE or materials driven by HE that might require fast, high-resolution, high-intensity radiography. The firing site can handle up to 154 pounds (70 kilograms) of explosives on the firing runway in front of machines. Charges up to 1,600 pounds (730 kilograms) or more of explosives may be detonated at points east of the runway (at greater distance from the PHERMEX machine). All of the buildings adjacent to the firing site are constructed of heavily reinforced concrete.

The DARHT facility is currently under construction near the PHERMEX firing site. When completed, the DARHT facility will provide dual axis, multiple exposure radiographs at the highest penetration and resolution available for the study of devices and materials under hydrodynamic conditions. This facility will be used primarily in support of DOE's Stockpile Stewardship and Management Programs.

The third firing site at TA–15 is located at building R306. Currently, the R306 firing site is used for nonradiographic studies. This firing site and the nearby IJ firing site are current candidates for redevelopment and would probably continue to be used only for electrical, mechanical, and optical studies in the future. The IJ site is currently in safe standby.

Both open-air and contained explosives tests are performed at TA–15 as described in the DARHT EIS (DOE 1995c) and ROD (60 FR 53588).

TA–36, Kappa-Site, contains four active firing sites. A variety of diagnostic equipment is available at the four firing sites. A number of 2.3-million electron volts, 600-kiloelectronvolts, 450-kiloelectronvolts, and 150-kiloelectronvolts flash radiographic systems are also available. (These radiographic systems may also be used at other firing sites.) In addition to providing support for DOE nuclear weapons programs, the explosives testing and firing facilities at TA–36 are often used for a wide variety of nonnuclear ordnance testing for the U.S. Department of Defense (DoD). These tests may include warhead development, armor and armor-defeating mechanisms, explosives vulnerability to projectile and shaped-charge attack, warhead lethality studies, and the safety implication of shock waves on explosives and propellants. A total of 700 to 1,200 experimental firings are performed annually, using up to 5,000 pounds (2,270 kilograms) of explosives in a single test.

The Ancho Canyon Site, TA–39, is used for studying high-energy-density properties in experiments using explosives-driven pulsed power. Various phenomenological aspects of explosives, interactions of explosives, and explosions acting on other materials are also investigated. Gas guns are located at Ancho

Canyon for the testing of inert materials. Typically, open air detonation is used, and up to 4,400 pounds (2,000 kilograms) of explosives may be used in a single test. In the past, contained testing involving plutonium was performed here. DOE may perform such testing again in the future.

Firing sites TA–39–6 and TA–39–88 typically support high-explosives-driven, pulsed-power experiments to study high-energy-density and high magnetic fields for stockpile stewardship, basic research, or other applications. These firing sites also can be used for other HE experiments in materials phenomenology. The pulsed-power experiments usually involve HE detonations and high-voltage, energy-storage capacitor bank discharges. Currently, for operational efficiency TA–39–6 is the principal firing site used for HE experiments for the National High Magnetic Field Laboratory, though both sites can be used for such experiments. The firing sites at TA–39 and the gas guns are used to measure the characteristics of weapons materials driving by HEs. Tests associated with proliferation control and verification activities are performed here also. Equation-of-state experiments may also be carried out at TA–39 to determine the properties of materials at extreme conditions.

Three separate firing sites at TA–40, DF Site, are used for general testing of explosives or other materials and in the development of special detonators to initiate HE systems. One site is used for the characterization of energetic materials using two gas guns normally located at TA–40. Another site employs a containment system in the study of small-scale experiments (less than 22 pounds [10 kilograms] of HE). The third site includes a laboratory for growth of long HE crystals used to study the properties of explosives. The TA–40 facility has been used for many years for the testing of HE and physics experiments related to the nuclear weapons programs.

Some experiments at TA–40 include detonation of assemblies and configurations contributed by other groups at LANL. Experimental assemblies containing up to 55 pounds (25 kilograms) of explosives in various diagnostic configurations are routinely constructed and fired, while detonation of charges of up to 110 pounds (50 kilograms) can be studied.

Description of Capabilities

The major categories of HE testing activities across the firing sites are described below. The manner in which these activities would vary among the alternatives is described in chapter 3.

Hydrodynamic Tests. A hydrodynamic test is a dynamic, integrated systems test of a mock-up nuclear package during which the high explosives are detonated and the resulting motions and reactions of materials and components are observed and measured. The explosively generated high pressures and temperatures cause some of the materials to behave hydraulically (like a fluid). Surrogate materials are used to replace the actual weapons materials in the mock-up nuclear weapons package, to ensure that there is no potential for a nuclear yield. Most hydrodynamic tests will be conducted at TA–15, with some being conducted at TA–36.

Dynamic Experiments. A dynamic experiment is an experiment to provide information regarding the basic physics of materials or characterize the physical changes or motion of materials under the influence of HE detonations. Some dynamic experiments involve SNM. Most dynamic experiments will be conducted at TA–15 and TA–36, with some experiments being conducted at TA–39 and TA–40. In the past, DOE has conducted dynamic experiments using plutonium metal. DOE may perform such studies again in the future at PHERMEX, DARHT, and other facilities. As a matter of policy, dynamic experiments involving plutonium would always be conducted inside containment vessels.

Explosives Research and Testing. Explosives research and testing activities are conducted primarily to study the properties of the explosives themselves as opposed to explosive effects on other materials. Examples include tests to determine the effects of aging on explosives, the safety and reliability of explosives from a quality assurance point of view, and fire resistance of explosives. Select explosive research and testing activities may be performed at any of the HE testing sites.

Munitions Experiments. Munitions experiments are those tests conducted to study the influence of external stimuli on explosives (i.e., projectiles or other impacts). These studies include work on conventional munitions for DoD. Most of the munitions experiments are expected be performed at TA–36, yet any of the other firing sites may be used as required.

High Explosives Pulsed-Power Experiments. High explosives pulsed-power experiments are those tests conducted to develop and study new concepts based on the use of explosively driven electromagnetic power systems. These experiments will be conducted primarily at TA–39.

Calibration, Development, and Maintenance Testing. Calibration, development, and maintenance testing are those experiments conducted primarily to prepare for more elaborate tests, and include tests to develop, evaluate, and calibrate diagnostic instrumentation or other systems. The calibration, development, and maintenance testing activities will be concentrated at TA–15 and TA–36, but may involve any of the HE testing sites.

Other Explosives Testing. Other explosives testing includes such activities as development of advanced HE and/or work to improve weapons evaluation techniques. Any of the HE testing sites may be used for select testing activities.

2.2.2.11 *Los Alamos Neutron Science Center (TA–53)*

LANSCE is the name applied to a group of facilities located at TA–53 (Figures 2.2.2.11–1 through 2.2.2.11–3). Initial construction of the original facility (then called the Los Alamos Meson Physics Facility, or LAMPF) was completed in 1970, and it remains one of the highest powered and largest research accelerators in the world. The LANSCE facility is located on a 750-acre (303-hectare) mesa top area, contains approximately 400 buildings and other structures, and houses about 700 personnel (Table 2.2.2.11–1). The number of personnel can increase by several hundred when the accelerator is in operation, as additional scientists are on site to monitor and participate in experiments.

LANSCE is LANL's major accelerator research and development complex. The facility produces intense proton beams and sources of pulsed spallation neutrons for neutron research and applications. The facility is composed of a high-power 800-million electron volt proton linear accelerator (linac), a proton storage ring (PSR), production targets at the Manuel Lujan Neutron Scattering Center (Manuel Lujan Center), and the Weapons Neutron Research (WNR) facility, and a variety of associated experiment areas and spectrometers. This facility uses particle beams to conduct basic and applied research in the areas of condensed matter science, materials science, nuclear physics, particle physics, nuclear chemistry, atomic physics, and defense-related experiments. LANSCE also produces medical radioisotopes. As a National User Facility for research in condensed matter sciences, LANSCE hosts scientists from universities, industry, LANL, and other research facilities from around the world.

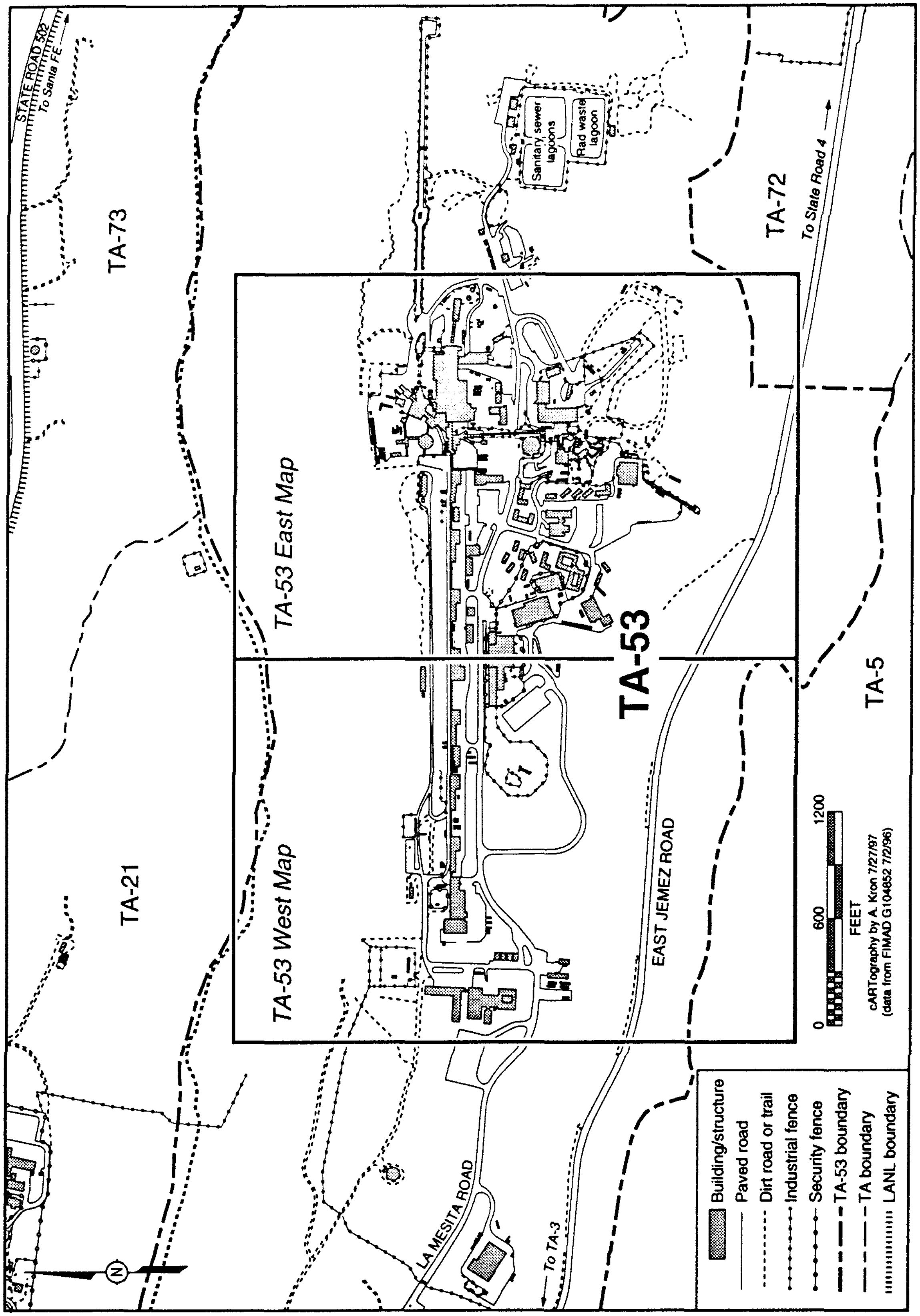


FIGURE 2.2.2.11–1.—*TA–53 Los Alamos Neutron Science Center.*

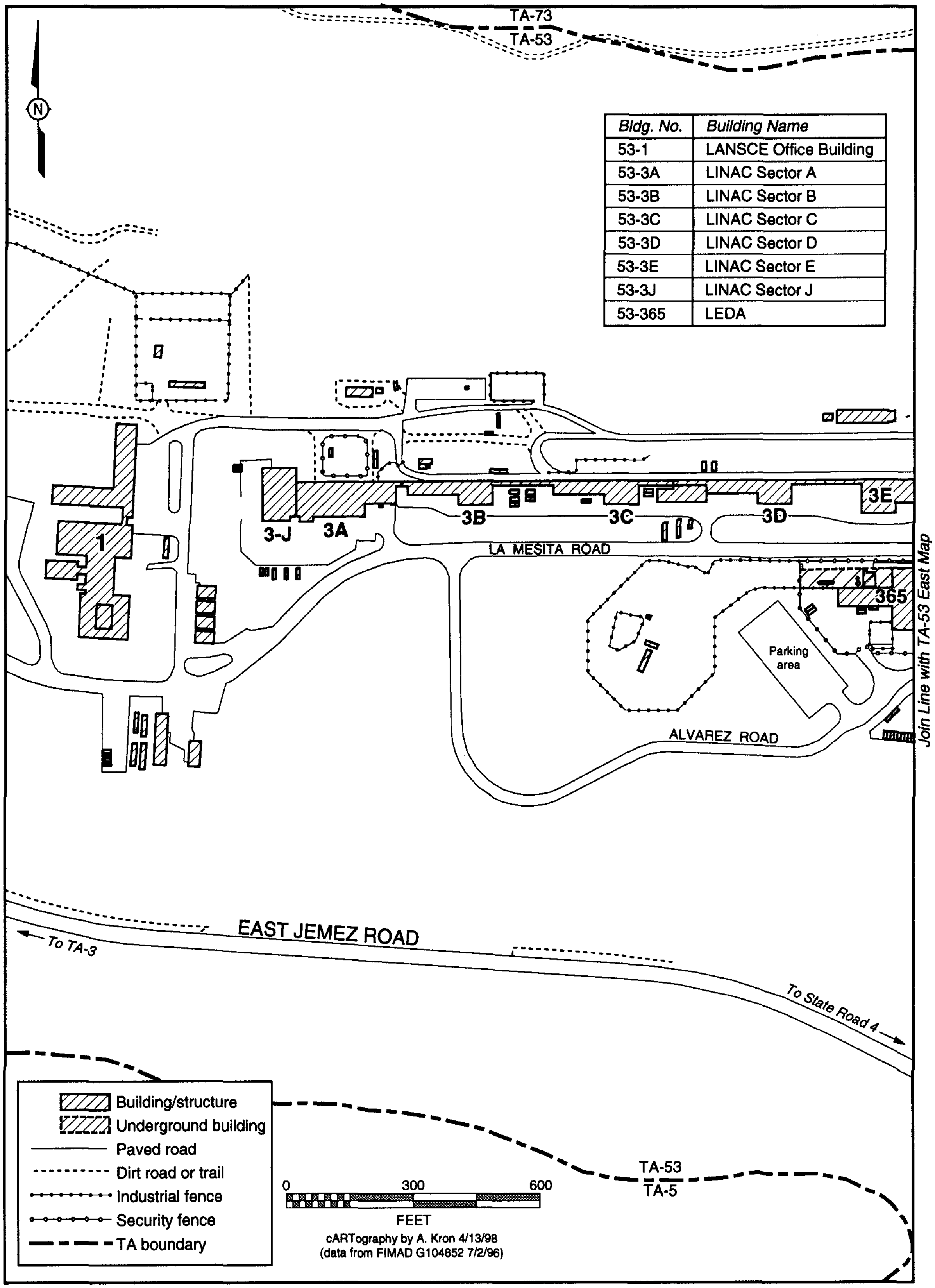


FIGURE 2.2.2.11–2.—*TA–53 Los Alamos Neutron Science Center West.*

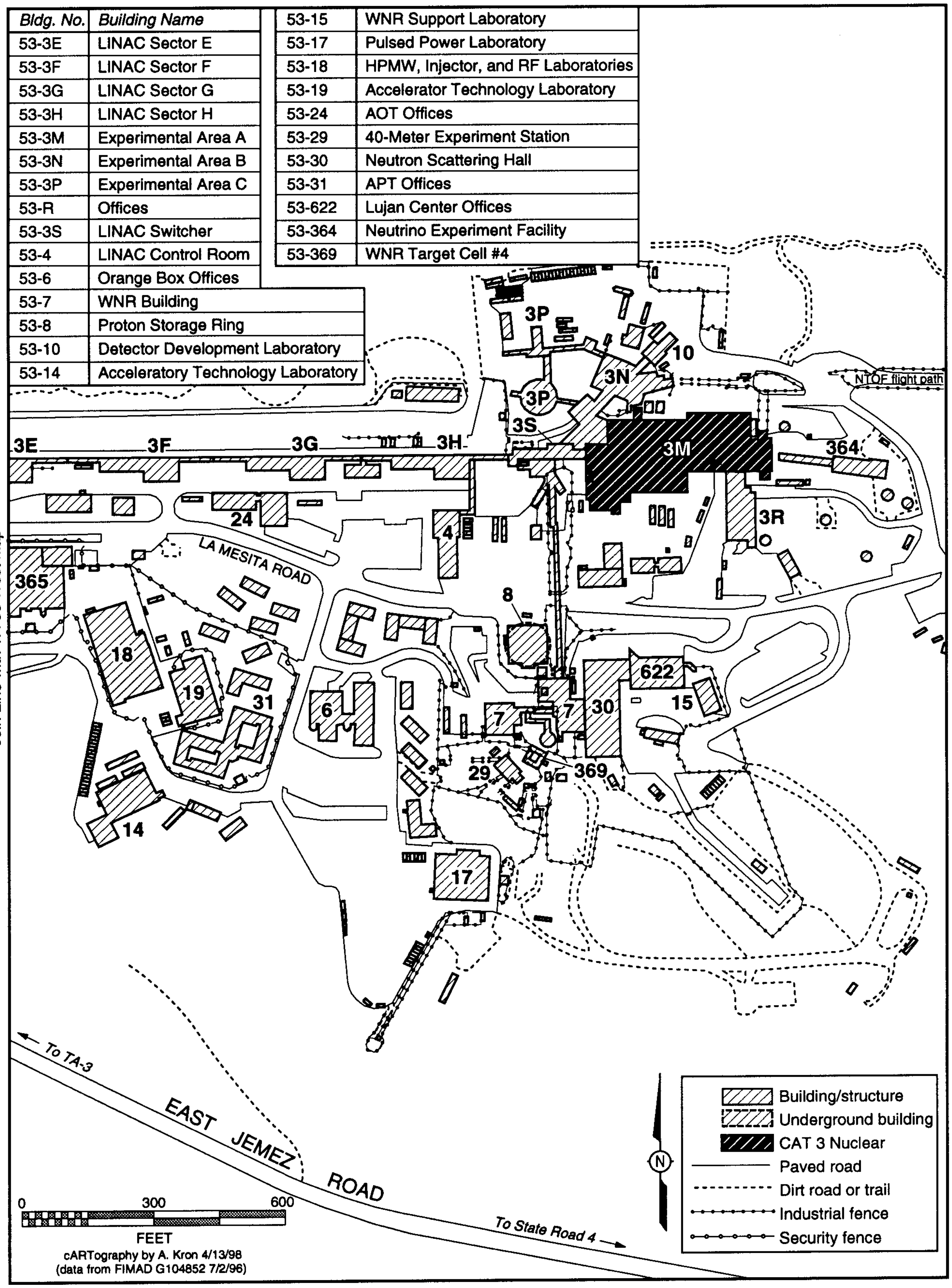


FIGURE 2.2.2.11–3.—*TA–53 Los Alamos Neutron Science Center East.*

TABLE 2.2.2.11–1.—*Principal Buildings and Structures of Los Alamos Neutron Science Center*

TECHNICAL AREA	PRINCIPAL BUILDINGS AND STRUCTURES
TA–53	**Accelerators:**
	Linear Accelerator Injector: 53–003J
	Proton Beam Linear Accelerator: 53–003A through H
	Linear Accelerator Switchyard: 53–003S
	Accelerator Control Room: 53–004
	Low Energy Demonstration Accelerator: 53–365
	Experimental Areas:
	Experimental Area A: 53–003M
	Experimental Area B: 53–003N
	Experimental Area C: 53–003P
	Neutrino Experiment Facility: 53–364
	Short-Pulse Spallation:
	Proton Storage Ring: 53–008
	Proton Storage Ring Equipment: 53–028
	Manuel Lujan Center Target, ER–1, Weapons Neutron Research Target #2: 53–007
	40-Meter Experiment Station: 53–029
	Manuel Lujan Center ER–2: 53–030
	Weapons Neutron Research Target #4: 53–369
	Major Laboratories:
	High-Resolution Accelerator Beam, Detector Development Laboratory: 53–010
	Accelerator Technology Laboratory (High-Powered Microwave and Advanced Accelerator): 53–014
	Weapons Neutron Research Support Laboratory: 53–015
	Pulsed-Power and Structures Laboratories: 53–017
	High-Powered Microwave, Injector and RF Laboratories: 53–018
	Accelerator Technology Laboratory: 53–019
	Other:
	LANSCE Office Building: 53–001
	Equipment Maintenance and Test Shop: 53–002
	"Orange Box" Office Building: 53–006
	Office Building: 53–024
	Office Building: 53–031
	Manuel Lujan Center Office Building: 53–622

LANSCE has 375 administrative, technical, physical support, and other buildings and structures assigned a no hazard classification. LANSCE also has 27 low hazard facilities. Twenty-one of these are classified as low hazard because of their radionuclide inventory and five due to potentially hazardous energy sources. LANSCE also contains one Hazard Category 3 nuclear facility, the isotope production facility within Building 53–003M (refer to Figure 2.2.2.11–3).

LANSCE accounts for more than 90 percent of all radioactive air emissions from LANL. These emissions come predominantly (greater than 95 percent) from stack ES–3, which ventilates Building 53–003, the linear accelerator and adjacent experimental stations. Additional emissions come from stack ES–2, which exhausts the PSR and experimental stations at the Manuel Lujan Center and WNR buildings. Both ES–2 and ES–3 are equipped with continuous monitoring equipment.

TA–53 contains six NPDES-permitted and NPDES-monitored outfalls. All of these outfalls discharge cooling tower blowdown. Three of the outfalls discharge into Los Alamos Canyon. The three remaining outfalls discharge into Sandia Canyon, one of which is slated for outfall reduction as part of LANL's Outfall Reduction Program. Effluent from two of the outfalls and from a former outfall has created three wetland areas in TA–53.

Low-level radioactive liquid wastes produced at LANSCE are collected and allowed to decay in four underground tanks prior to discharge to a lined lagoon. Two unlined wastewater lagoons (no longer used) collected sanitary wastes prior to construction of the sanitary waste treatment facility at TA–46. Traces of both radioactive and hazardous wastes have been discovered in the sludges in these lagoons, and they now require a formal closure under RCRA. Radioactive solid wastes such as beam line components and scrap metals, papers, and plastics are also produced at LANSCE. Small quantities of hazardous and toxic wastes such as liquid solvents, solvents on wipes, lead, and solder are produced from accelerator maintenance and development.

Support activities at TA–53 provide for facility and plant operating and engineering services, environment, safety, and health services and oversight, site and building physical security, visitor control, and facility specific training.

Description of Facilities

The heart of TA–53 is the linear accelerator, or linac, itself, Building 53–003. It is more than 0.5 mile (0.8 kilometer) in length, and has 316,000 square feet (29,390 square meters) of floor space. The building contains equipment to form hydrogen ion beams (protons and negative hydrogen ions), and to accelerate them to 84 percent of the speed of light. Ancillary equipment is used to transport the ion beams, maintain vacuum conditions in the beam transport system, and provide ventilation and cooling. Creating and directing the ion beam requires large amounts of power, much of it ultimately removed as excess heat. The beam tunnel itself is located 35 feet (11 meters) below grade (i.e., below the ground) to provide radiation protection. Above-surface structures house radio frequency power sources used to accelerate the beam.

In the linear accelerator, an 800-million electron volt proton beam is generated in three stages. The linear accelerator has the capability to simultaneously accelerate both H^+ and H^- ion beams. In the first stage, three injectors (Building 53–003J) generate ionized H^+ or H^- beams, which are accelerated to 4 percent of the speed of light (corresponding to an energy level of 0.75 million electron volts).

The second stage (Building 53–003A) consists of a 203-foot (62-meter) series of drift-tube linear accelerator sections. By alternately exposing the proton ion beam to, and shielding it from, an externally generated electromagnetic field, ions are accelerated and exit this second stage at 43 percent of the speed of light (corresponding to an energy level of 100 million electron volts).

The third stage (Buildings 53–003B through 53–003H) consists of a 2,400-foot (731-meter) long side-coupled cavity accelerator. Ions exit at 84 percent of the speed of light with an energy level of 800 million electron volt (Allred and Talley 1987, pp. 10-13).

The ion beam then enters a switchyard (Building 53–003S), where the H^+ and H^- beams are split and directed to Experimental Areas A, B, C, WNR Building, and/or the PSR. The PSR converts the negatively charged beam into short (250 nanoseconds) intense pulses of protons. These pulses are delivered to the Manuel Lujan Center neutron production target at a rate of 20 per second.

At present, the 800-million electron volt linear accelerator is the only operating proton beam at TA–53. This will change when the Low-Energy Demonstration Accelerator (LEDA) becomes operational in late 1998. The environmental impacts of this facility were analyzed in the *Low-Energy Demonstration Accelerator Environmental Assessment* (DOE 1996b). LEDA will generate lower-energy protons (40-million electron volts as compared to the 800-million electron volt beam discussed above), but at a much higher beam current (200 milliamps versus 1). LEDA operations will be conducted in Building 53–365.

Description of Capabilities

The major categories of LANSCE activities are described below. The manner in which these activities would vary among the alternatives is described in chapter 3.

Accelerator Beam Delivery, Maintenance, and Development. Generation and delivery of the proton ion beams requires significant development and maintenance capabilities for all components of the 800-million electron volt accelerator, including the ion sources and injectors, the mechanical systems in the accelerator (including cooling water), all systems for the PSR and its associated transfer lines, and beam diagnostics in the accelerator and transfer lines. Beam development activities include beam dynamics studies, and design and implementation of new capabilities. This activity requires the coordination of many disciplines, including accelerator physics, high-voltage and pulsed-power engineering, mechanical engineering, materials science, radiation shielding design, digital and analog electronics, high vacuum technology, mechanical and electronics design, mechanical alignment, hydrogen furnace brazing, machining, and mechanical fabrication. These activities take place throughout Building 53–003 (800-million electron volt accelerator), and in Buildings 53–008/028 (PSR), 53–365 (LEDA), 53–002 (equipment maintenance and test shop), and Line D (Manuel Lujan Center and WNR).

The short-pulse spallation source enhancement will result in higher neutron flux and greater beam availability from experimenters in WNR and the Manuel Lujan Center. (This project was categorically excluded from further NEPA review.) The upgrade would enhance the existing H^+ beam and the PRS to operate at 200 microamps and 30 hertz (versus the current 70 microamps at 20 hertz) and will add from five to seven new neutron-scattering instruments to the Manuel Lujan Center. All modifications will occur within existing buildings.

Experimental Area Support. Experiments using proton and neutron beams are conducted by personnel from the LANSCE and Physics Divisions, other LANL organizations, and other users such as scientists from universities, other laboratories, and the international scientific community. These beam users require support from TA–53 personnel, whether preparing for, performing, or closing out their experiments. This support capability focuses on the maintenance, improvement and operational readiness of the high intensity beam line (Line A) and associated secondary beam lines and experimental areas at LANSCE. This requires the specification, engineering, design utilizing computer-aided design (CAD), fabrication (often using computer-aided manufacturing), installation, and checkout and maintenance of various beam line components (and their controls and interlocks) including: particle production targets, uncooled and water-cooled devices such as magnets, beam stops, vacuum enclosures and beam collimators (fixed and movable), and absorbers.

Support also includes: the design, operation, and maintenance of remote handling systems for highly activated components; the handling and transportation (usually for disposal) of highly activated components; and the specification, engineering, design and installation of radiation shielding. Shielding activities include Monte Carlo shielding calculations and heavy equipment (bridge cranes and forklifts) operation.

Support activities occur in all of the experimental support areas: A (Building 53–003M), B (53–003N), C (53–003P), Manuel Lujan Center (53–007, 53–029, and 53–030), WNR (53–007 and 53–369), and the neutrino experiment hall (53–364).

Radiofrequency Technology and Operation. The 800-million electron volt and LEDA accelerators require large power sources, and both are supplied at TA–53 by radiofrequency (RF) power sources. The capability to design, fabricate, operate, and maintain RF systems for accelerators and other applications is an important support function for LANSCE operations. This capability also provides the RF systems, including state-of-the-art fast feedback controls and high-power klystron amplifiers used in electron accelerator projects and other advanced accelerator concepts at TA–53. RF technology development also supports microwave materials processing and RF system design. Design work includes determining optimal systems for very high-power continuous-duty systems for applications such as accelerator production technology.

RF power generation for the 800-million electron volt accelerator primarily occurs in the above-surface portions of Building 53–003, Sectors A through H, and will occur in Building 53–365 for LEDA.

Neutron Research and Technology. Fundamental research is conducted on the interaction of neutrons with various materials, molecules, and nuclei to advance condensed matter science (including material science and engineering and aspects of bioscience), nuclear physics and LANL's capability in the study of dynamic phenomena in materials. Applied neutron research is conducted to provide scientific and engineering support to weapons stockpile stewardship and nonproliferation surveillance. Efforts include resonance neutron spectroscopy and neutron radiography. (Radiography using protons rather than neutrons is discussed below under Subatomic Physics Research.) Research is also performed to develop instrumentation and diagnostic devices by scientists from universities, other federal laboratories, and industry.

Accelerator-Driven Transmutation Technology. This research area probes the use of a fundamentally different approach to the management of nuclear waste by using an accelerator beam to convert plutonium and high-level radioactive wastes into safer elements. Planned experimental progression will start by performing tests to establish a technology base for materials handling and operation of liquid lead spallation neutron targets, including the assembly and testing of a Russian built lead/bismuth target (using a 1-megawatt target/blanket, expected to be categorically excluded from further NEPA review by May 1, 1998). This liquid lead technology could then be used to construct a target/blanket assembly for low-power (up to 5 megawatts) experiments with representative fission products and fissionable materials. These experiments will allow measurement of the production and removal of spallation products and fission products, and the testing of transmutation effectiveness in different configurations.

Subatomic Physics Research. Historically, a wide variety of subatomic physics research was conducted at this accelerator facility. Currently, experiments are conducted at the Liquid Scintillator Neutrino Detector Facility (Building 53–364) in conjunction with several universities. Atomic parity nonconservation experiments are conducted in Area A. These use a thin target to produce unstable isotopes, and detectors to measure their properties. Research built on subatomic physics techniques and knowledge is also developing the technology for, and use of, neutron and proton radiography for stockpile stewardship applications. Experiments to date have been directed at radiographing static objects using WNR and small, contained dynamic experiments in Line B, utilizing appropriate locations for access to the proton beam. These experiments have demonstrated the utility of the technique and provide data on explosives behavior. Experiments take place in Line C, which allows room for continued dynamic materials research studies and technique development. This research includes development and demonstration of advanced detectors.

Medical Isotope Production. The 800-million electron volt accelerator proton beam is used to produce radioisotopes used by the medical community for diagnostic procedures, therapeutic treatment, clinical trials, and biomedical research. Nearly 40 different medical radioisotopes have been produced and shipped in the 20 years of production at LANL. During 1995, for example, 75 shipments were made to user facilities in nine countries, including France, Germany, and Australia.

Isotopes are currently produced at the Isotope Production Facility (IPF), at the linear accelerator beam stop in Area A (Building 53–003M). The IPF currently makes use of that portion of the proton beam that is not consumed by and used for proton and neutron experiments and research. The IPF has nine independent stringers or target stations. A small amount of target material is loaded onto each movable stringer, and the stringer is inserted into the proton beam path. Remote handling equipment and water-cooled targets are required due to the high radiation levels (up to 50,000 roentgen per hour) and temperatures (up to 1,832°F [1,000°C]) generated by the spallation process. Isotope production and facilities will be relocated to a new 100-million electron volt station in an add-on to Building 53–003B. This change will result in more selective and more efficient isotope production and the generation of fewer byproduct isotopes (as compared to the current use of the 800-million electron volt beam).

are transported from TA–53 to the Radiochemistry Facility in TA–48 (described in section 2.2.2.13) for recovery of the desired radioisotopes from the target material.

High-Power Microwaves and Advanced Accelerators. High-power microwave research and experiments, mostly conducted in Buildings 53–014 and 53–018, occur in a number of technology areas: (1) high-power microwave, RF, and electromagnetic pulse sources that typically use multi-kiloampere, relativistic electron beams; (2) future linac power sources and directed energy; (3) explosively driven high-power microwave and RF systems for defense applications; (4) intense beam physics and modeling for application to high-power microwave source development; (5) high-power, free-electron lasers based on high-brightness electron accelerators; (6) high-brightness accelerator as a driver for an extreme UV source for lithography; (7) high-performance ground penetrating radar for environmental remediation; (8) application of high-power microwaves to industrial processing, such as chemical catalysis and environmental remediation; (9) microwave and electromagnetic pulse vulnerability and effects testing of weapons systems; (10) novel high-power microwave sources based on shock compression of solid materials; (11) advanced pulsed-power modulator development; (12) development of room-temperature and superconducting RF linac structures; and (13) development of advanced electron accelerators. Research also will be conducted to support development of the spallation neutron source (as discussed in chapter 1, section 1.5.9).

2.2.2.12 *Health Research Laboratory (TA–43)*

The Health Research Laboratory (HRL) complex within TA–43 includes the main HRL and 13 support buildings and facilities (Figure 2.2.2.12–1 and Table 2.2.2.12–1). The Life Sciences Division is the primary occupant of TA–43 and is responsible for management, and safety measures, procedures, and most of the research and experimental science activities at HRL. Three of the support buildings and structures have low hazard classifications. HRL is designated a low hazard as a radioactive material source and low hazard as a chemical source facility. One transportable building houses lasers and is designated low hazard as an energy source, and a safety storage shed where chemical waste is stored is assigned a low hazard as a chemical source. The other buildings have no hazard classification.

TABLE 2.2.2.12–1.—*Principal Buildings and Structures of the Health Research Laboratory*

TECHNICAL AREA	PRINCIPAL BUILDINGS AND STRUCTURES
TA–43	Offices, Laboratories: 43–1, 20, 24, 37 Sewage Lift Station: 43–10 Storage: 43–12, 28, 36, 46 Cooling Tower: 43–44 Computer/Instrument Assembly Building: 43–45 Chemical Storage Sheds: 43–47, 49, 61

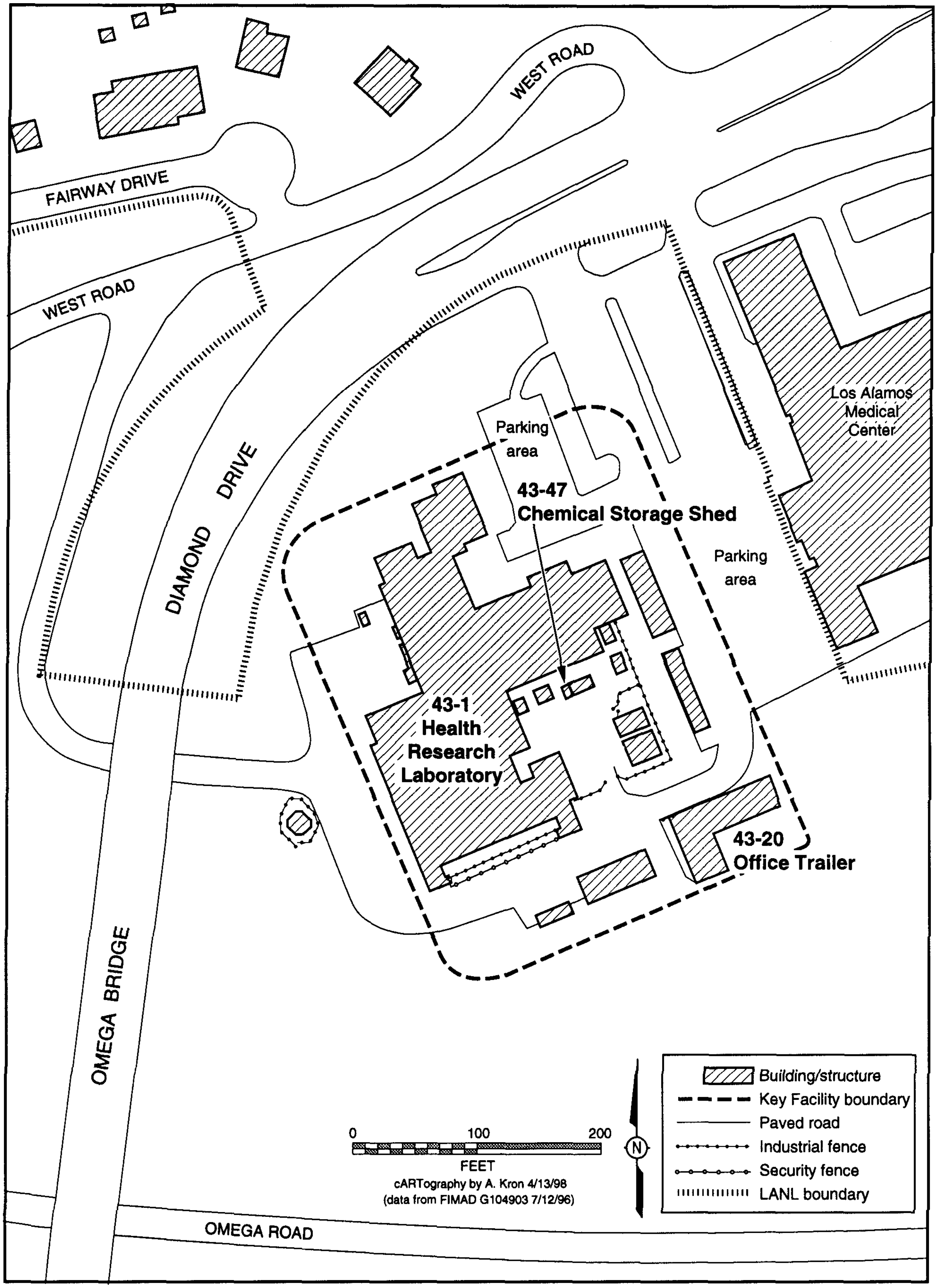


FIGURE 2.2.2.12–1.—*TA–43 Health Research Laboratory.*

Description of Facilities

Research areas in HRL focus on trying to understand the relationships between energy and health by studying the effects of different types of radiation and chemicals on cells and subcellular components. This research is important to DOE because of its work in nuclear fission and fossil fuels, both of which generate byproducts that can affect human health by damaging deoxyribonucleic acid (DNA) and can lead to carcinogenesis.

Small quantities of many toxic and hazardous chemicals are transported to and used in research projects at HRL. They include solvents, flammable materials, dilute suspect carcinogens, certain recombinant biological preparations, and compressed gasses. There are four low-level radioactive sources used for the irradiation of samples: two cesium-137 sources, one cobalt-60 source, and one plutonium-238 source. In addition, several sealed sources of depleted uranium (uranium-238) are used to check personnel monitoring equipment. Radioisotope-labeled compounds are also used in small volume operations and include phosphorus-32, phosphorus-33, and sulfur-35. All are short-lived (half lives in days) beta emitting radionuclides. Radioactive wastes are typically allowed to decay before being discarded. Operations at HRL may involve samples that contain radionuclides as well as dilute suspect carcinogens and other hazardous chemicals.

Chemical and radiological wastes produced at HRL are disposed of through LANL's waste management system. Animal tissues and carcasses are identified as infectious medical wastes and are disposed of as medical wastes (biohazard) through an off-site commercial firm that destroys such waste. All cells, subcellular materials, and culture media are sterilized and then disposed of along with solid wastes at the Los Alamos County Landfill. Wastes from the animal colony are also disposed of as administrative wastes in the Los Alamos County Landfill because the animals are not used as hosts for disease organisms and intact animals are not treated with radioactive materials (the animal colony has rats, mice, rabbits, and similar small mammals, but no primates or large mammals). Wastewater from animal colony cleaning operations is disposed of into the sanitary sewage system. All of the research activities at HRL produce low volumes of waste.

There is one outfall associated with HRL, and it discharges cooling water from lasers into Los Alamos Canyon. The Life Sciences Division is considering the elimination of this outfall and discharging cooling water instead to the Los Alamos County Sewage Treatment Facility. Further NEPA review would be prepared for any such proposal.

Because of its location, utilities (gas, water, and electricity) are delivered to HRL from Los Alamos County distribution systems. These delivery systems are metered, unlike most of the other facilities at LANL.

Description of Capabilities

The capabilities at HRL are described below.

Genomic Studies. These studies are directed at understanding the organization, replication, and regulation of complex genomes.

Cell Biology. Activities are directed at understanding how whole cells respond to insults from the environment, including ionizing radiation and oxidants.

Cytometry. Activities focus on developing, refining, and applying laser-based techniques for imaging and analyzing biological materials such as whole cells and subcellular organelles.

DNA Damage and Repair. Studies involve how DNA is damaged and how it is repaired.

Environmental Effects. Studies involve the ecology of microbes and how the DNA and protein components in microbes are changed as a result of changes that humans introduce into the environment.

Structural Cell Biology. These are activities to understand the structure, functions, and interactions of subcellular structures and biological macromolecules.

Neurobiology. These activities include studies of the functions of the human brain, using magnetic waves generated by the brain to map the areas that become active as the brain receives certain sensory stimuli and goes through thinking/reasoning activities.

In-Vivo Monitoring. This activity provides a service to other LANL operations. Extremely sensitive detection equipment measures photons emitted by the bodies of workers to determine whether they have inhaled any radioactive material.

2.2.2.13 *Radiochemistry Facility (TA–48)*

The Radiochemistry Facility at TA–48 was constructed from 1955 through 1957. The entire TA covers 116 acres (47 hectares), but the main buildings are enclosed behind a security fence on 8.6 acres (3.5 hectares) (Figure 2.2.2.13–1). TA–48 contains five research buildings: the Radiochemistry Laboratory (48–1), the Isotope Separator Facility (48–08), the Diagnostic Instrumentation and Development Building (48–28), the Advanced Radiochemical Diagnostics Building (48–45), and the Analytical Facility (48–107) (Table 2.2.2.13–1).

The Radiochemistry Facility is a research facility that fills three roles. Research supports environmental management projects (e.g., Yucca Mountain Project, plutonium stabilization), catalysis, basic energy, and other scientific endeavors. Chemistry research is performed in the areas of inorganic, actinide,

TABLE 2.2.2.13–1.—*Principal Buildings and Structures of the Radiochemistry Facility*

TECHNICAL AREA	PRINCIPAL BUILDINGS AND STRUCTURES
TA–48	Radiochemistry Laboratory: 48–1 Isotope Separator Facility: 48–8 Diagnostic Instrumentation and Development Building: 48–28 Advanced Radiochemical Diagnostics Building: 48–45 Analytical Chemistry Facility: 48–107

organometallic, environmental, geochemistry and nuclear chemistry. The Radiochemistry Facility is also a production facility, using the hot cell in Building 48–01 to separate and package radioisotopes needed and used by researchers, physicians, hospitals, and pharmaceutical companies all over the world. In a typical year, the LANL isotopes program makes more than 150 shipments of up to 30 different isotopes, some of which are available only from LANL. In addition, the facility provides services to other LANL organizations (e.g., samples are analyzed at TA–48 as part of the environmental surveillance program).

Description of Facilities

Building 48–01 is a Hazard Category 3 nuclear facility, and the other four laboratory buildings are classified as low-level radiological hazard. Twenty-six other structures are classified as no hazard, including trailers, transportable buildings, metal sheds, office buildings, and storage facilities.

The Radiochemistry Laboratory is a single-story building with a basement and a penthouse. With slightly more than 100,000 square feet (9,300 square meters) of floor space, Building 48–01 is divided into several wings for differing types of research:

- Laboratory wings for light chemical analysis and research

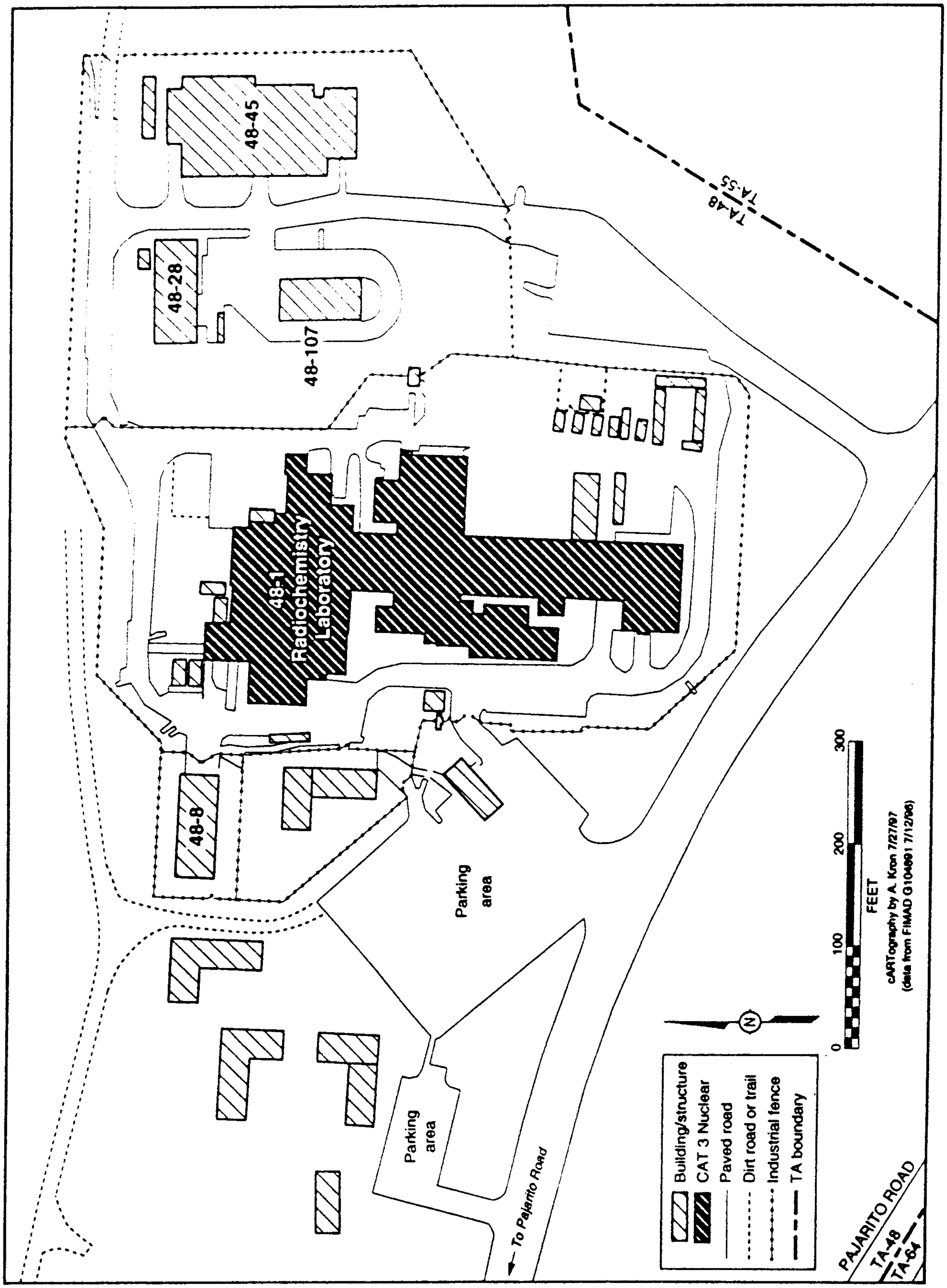


FIGURE 2.2.2.13–1.—*TA–48 Radiochemistry Facility.*

- A hot cell for the separation, packaging, and shipment of radioisotopes to medical facilities, research institutions, and pharmaceutical firms
- An alpha wing for research with plutonium and other alpha-emitting radionuclides
- A counting wing, which houses detectors and equipment for the assay of radioactive samples. There is also an office wing and a secure wing for historical weapons data. Most radiochemical research is conducted on the main floor, although a few laboratories are located in the basement. The basement also houses utilities, support systems, and ventilation exhaust fans and ductwork. Ventilation intake fans and heating and cooling units are located in the penthouse.

Three exhaust stacks at Building 48–01 are continuously sampled for radioactive emissions in accordance with requirements of the EPA's National Emission Standards for Hazardous Air Pollutants (NESHAP): FE–7 (hot cell), FE–54 (the alpha wing), and FE–60 (hot cell dilution bench). Building 48–01 also discharges cooling tower waters through three outfalls into Mortandad Canyon.

Research at the Isotope Separator Facility (48–08) includes the separation and collection of radioactive isotopes for analytical quantification and the development of equipment used for isotope separation. Building 48–28 has two laboratories; one houses five laser systems and two mass spectrometers used for environmental research experiments, and the other is used to analyze radioactive water samples.

The Advanced Radiochemical Diagnostics Building (48–45) contains 11 chemistry and 7 instrument laboratories. These laboratories are clean rooms designed to minimize the effect of environmental factors on the accuracy of isotope measurements for experiments in solar physics, geosciences, biology, and atmospheric science.

The Analytical Chemistry Facility (48–107) contains four light chemistry laboratories and a laser laboratory and is used to support environmental research, catalysis research, and inorganic chemistry.

Description of Capabilities

There are several services and capabilities available at TA–48: radionuclide transport studies, environmental restoration support, ultra-low-level measurements, nuclear and radiochemistry, high-level beta/gamma chemistry, actinide TRU chemistry, data analysis, inorganic chemistry, structural analysis, and sample counting. Each of these is described below. The manner in which these activities would vary among the alternatives is described in chapter 3.

Radionuclide Transport. Numerous chemical and geochemical investigations are undertaken that address concerns about hydrologic flow and transport of radionuclides. Areas of study include the sorption (binding) of actinides, fission products, and activation products in minerals and rocks, and the solubility and speciation of actinides in various chemical environments (e.g., environments associated with waste disposal). These studies are paired with the development of models to evaluate, for example, the parameters for performance assessment of mined geologic disposal systems.

Environmental Remediation. Environmental remediation capabilities at TA–48 fall into two categories: characterization and remediation of soils contaminated with radionuclides and toxic metals; and data analysis and integrated site-wide assessment. In characterizing and remediating soils contaminated with radionuclides and toxic metals, a major objective is to minimize the generation of large volumes of metal- and radionuclide-contaminated soils. The objective of data analysis and integrated side-wide assessment is to accelerate remediation through improved sampling schemes, clearer and more efficient evaluation of characterization data, and more effective tools for assigning priority to cleanup targets.

Ultra-Low-Level Measurements. Isotopic tracers and high-sensitivity measurement technologies have been developed to support the U.S. nuclear weapons program. The isotopic tracers can include both radioactive and nonradioactive isotopes, with emphasis on the nonradioactive. Some are commercially available, and some can be produced at LANL. The research staff also specializes in developing analytical techniques for a variety of problems in nuclear, environmental, and biological sciences.

Mass spectrometers detect and analyze samples as small as one-thousandth of one-billionth of a gram. Chemical separation procedures to isolate the element to be measured are conducted in a chemistry laboratory specially designed to keep the sample from being contaminated by natural or man-made sources. This technique can determine both the source and the amount of radioactive contamination. For example, these efforts allow determination of whether radiation in an environmental sample results from contamination from a nearby nuclear reactor or from radioactive fallout from global weapons testing. LANL researchers can also trace the migration of radioactive contamination through the environment.

Nuclear/Radiochemistry. Activities under this capability include developing radiation detectors, conducting radiochemical separations, and performing nuclear chemistry. Development, calibration, and use of radiation detectors include the use of off-the-shelf systems for routine measurement of radioactivity and development of new radiation detection systems for a number of special applications. LANL conducts both routine and special separations of radioactive materials from other radioactive species and stable impurities. These experiments have provided support to Hanford waste tank treatment activities and production of medical isotopes. Separations are based on traditional approaches that use commercially available ion-exchange media, extractants, and other reagents. LANL also develops new separations based on experimental chemical systems, using radioactive tracers to synthesize the chemicals and to characterize their performance.

Nuclear chemistry efforts use exotic laser-based atom traps for probing the interactions of energy and atoms in energy regimes not easily accessed by other techniques. This work requires conducting extensive laser spectroscopy, handling of radioactive materials, and interpreting the resulting data. In other nuclear chemistry efforts, targets are irradiated and isotopes are captured at LANSCE (described in section 2.2.2.11) or at off-site reactors to produce specific radioactive isotopes. These isotopes are then separated from impurities, and their neutron capture cross sections are measured at TA–48.

Isotope Production. This capability produces, chemically separates, and distributes isotopes to the medical and industrial user communities. TA–48 activities include preparing the target packages that will be irradiated to make isotopes, transporting these packages to the LANSCE accelerator (described in section 2.2.2.11), inserting them into the proton beam, retrieving them from the beam, and transporting them back to TA–48. Once the target packages arrive back at TA–48, they are disassembled and the target material is moved to a chemistry hot cell for processing to recover the desired isotopes. Post-irradiation activities associated with these targets must be carried out using remote handling techniques. Separated isotopes are packaged for shipment and are distributed to customers throughout the world.

Actinide/Transuranic Chemistry. The activities in the alpha wing are essentially the same as the radiochemical separations carried out in the rest of the facility. The materials handled are actinides and transuranics (elements with an atomic weight greater than that of uranium [92]) that require the special safe-handling environment provided in this wing.

Data Analysis. Data analysis is the process of taking information learned from all of the measurements made on a material and putting it into the context of the experimental design. This process is a paper exercise that turns data into useful information that will help answer experimenters' questions.

Inorganic Chemistry. Inorganic chemistry work at TA–48 includes two main categories of activities: (1) synthesis, catalysis, and actinide chemistry and (2) development of environmental technology. The former category includes chemical synthesis of new organometallic complexes, structural and reactivity analysis, organic product analysis, reactivity and mechanistic studies, and synthesis of new ligands for radiopharmaceuticals. Development of environmental technology includes designing and synthesizing ligands for selective extraction of metals, soil washing, development of membrane separators, photochemical processing, and ultrafiltration. Other work involves oxidation reduction studies on uranium and other metals for both environmental restoration and advanced processing.

Structural Analysis. Structural analysis at TA–48 includes the synthesis, structural analysis, and x-ray diffraction analysis of actinide complexes in both single-crystal and powder form. This capability supports programs in basic energy sciences, materials characterization, stockpile stewardship, and environmental management.

Sample Counting. Sample counting, the measurement of the quantity of radioactivity present in a sample, is accomplished with a variety of radiation detectors, each customized to the type of radiation being counted and the expected levels of radioactivity. All samples counted in the counting facility are sealed items that are placed inside appropriate detectors for a specified period of time. At the end of the count, the data are automatically processed through the computer system and results are presented to the users. Other activities in the counting room include system calibration, quality checks on system performance, and corrective action when problems occur.

2.2.2.14 *Radioactive Liquid Waste Treatment Facility (TA–50)*

TA–50 is located near the center of LANL (see Figure 2.2.2.14–1 and Table 2.2.2.14–1). Its 62 acres (25 hectares) are the home for 33 total waste management structures, including office trailers, tanks, storage sheds, and four buildings. Approximately 110 people participate in the following waste management activities:

- Treatment of radioactive liquid wastes
- Decontamination of respirators, equipment, instruments, vehicles, and waste items
- Size reduction of TRU waste
- Characterization of TRU waste

As discussed in the SWEIS Notice of Intent, the DOE had, at one time, proposed a construction project to replace the aging RLWTF. Given the

TABLE 2.2.2.14–1.—*Principal Buildings and Structures of the Radioactive Liquid Waste Treatment Facility*

TECHNICAL AREA	PRINCIPAL STRUCTURES AND BUILDINGS
TA–50	Radioactive Liquid Waste Treatment Facility: 50–1 Decontamination Trailer: 50–185

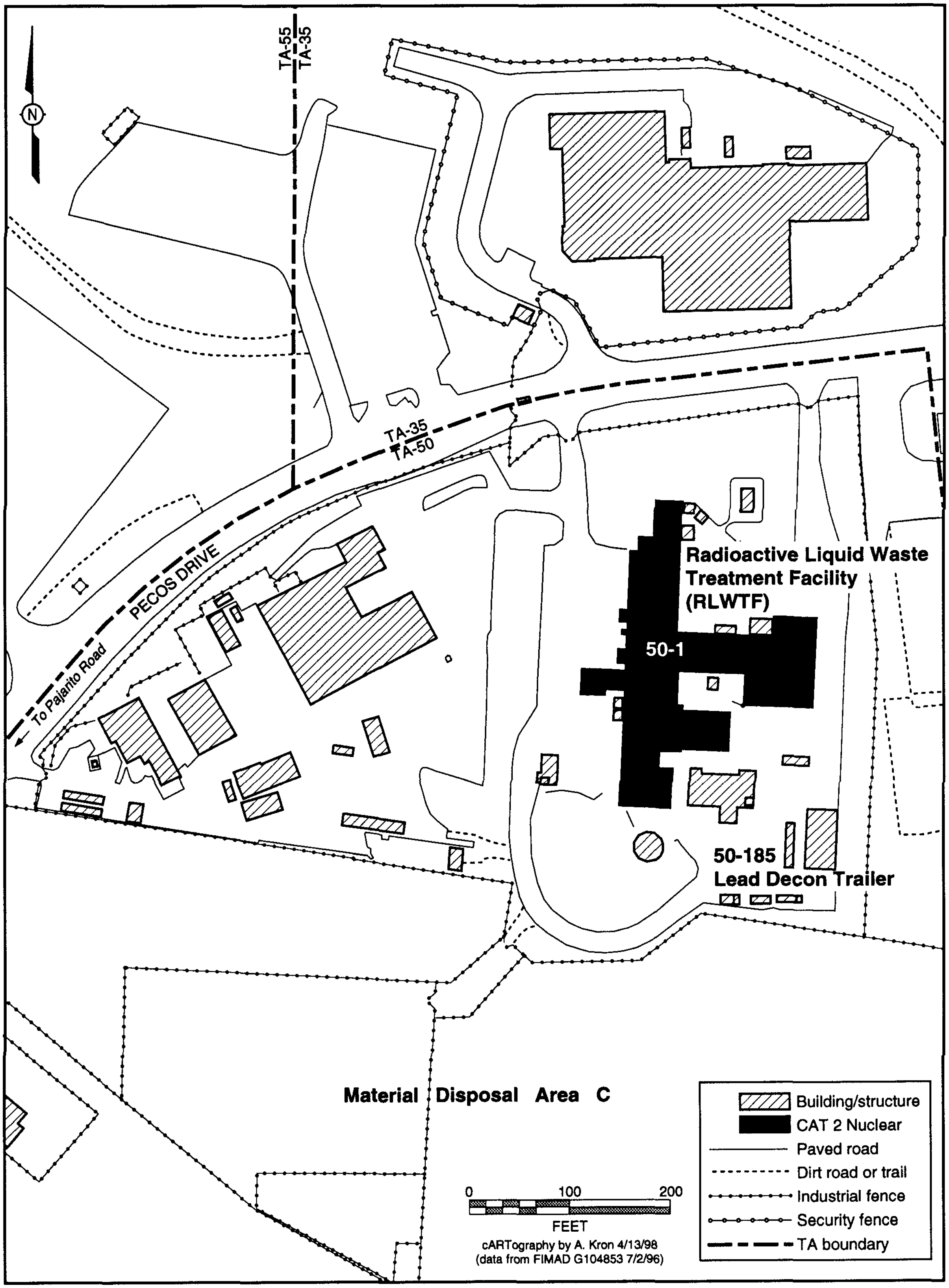


FIGURE 2.2.2.14–1.—*TA–50 Radioactive Liquid Waste Treatment Facility.*

cost of such a replacement facility, DOE withdrew that project and initiated studies to benchmark the "best in class" private-sector radioactive liquid waste treatment options. The DOE currently is considering various options for future liquid waste treatment, including the benefits of a centralized versus a decentralized approach (at the point of generation). In recognition of potential environment, safety, and human health issues associated with operations in an aging facility, as well as compliance issues regarding the effluent from the RLWTF, the DOE has been upgrading the facility and treatment technologies utilized. Upgrades have included retrofitting to upgrade or replace tanks and pipes (which are now double-walled), ventilation and air monitoring systems, and a treatment system (discussed later in this section). Future upgrades or replacement proposals would be subject to NEPA reviews tiered from this SWEIS.

Description of Facilities

Waste management operations at TA–50 principally take place at three facilities: the RLWTF, the Radioactive Materials Research, Operations, and Demonstration (RAMROD) Facility, and the Waste Characterization, Reduction, and Repackaging (WCRR) Facility. Activities in the RAMROD and WCRR facilities are associated with TRU wastes, and are described as part of the Solid Radioactive and Chemical Waste Facility (described in section 2.2.2.15).

RLWTF (Building 50–01) is the largest structure at TA–50 with 40,000 square feet (3,720 square meters) under roof. It is a Hazard Category 2 nuclear facility. Liquid wastes from the plutonium facility at TA–55 (described in section 2.2.2.1) are pre-treated in Room 60, then added to influent tanks that collect radioactive liquid waste from other LANL facilities. These combined liquid wastes are processed, then collected in tanks, and, if in compliance with regulatory standards, discharged into Mortandad Canyon. Improvements in treatment technology (ultrafiltration/reverse osmosis) are planned to come online by early 1999. LLW sludge from the chemical treatment step is drummed and sent to TA–54 for disposal, while TRU sludge is solidified and sent to TA–54 for storage pending eventual disposal (described in section 2.2.2.15).

The south wing of the basement of Building 50–01 houses equipment for the decontamination of personnel respirators from LANL operations, vehicles, equipment, portable instruments, precious metals, and scrap metal. Decontamination solutions are drained to influent tanks for radioactive liquid waste and LLW treatment operations. Decontamination allows re-use of respirators and equipment, and recycle of materials such as precious metals and scrap metals. It also reduces the volume of wastes that must be disposed.

The Lead Decontamination Trailer, Building 50–185, is located just behind the RLWTF. Here, contaminated lead bricks are subjected to a grit blast and subsequent water wash to remove radioactive contamination. Bricks are then re-used within the laboratory. Spent grit is packaged as solid LLW or TRU waste and sent to TA–54 for disposal or storage. Wash solutions are drummed, sampled, and transported to RLWTF for treatment.

There are seven concrete underground storage tanks (USTs) adjacent to RLWTF. These range in size from 2,600 to 75,000 gallons (9,840 to 283,875 liters). However, two of three existing influent USTs were replaced by four aboveground steel tanks. This 1.4-million-dollar modification to the tank farm (Building 50–02) was completed in 1997. The total influent holding capacity remains at 50,000 gallons (190,000 liters).

Each of the three major buildings at TA–50 has a stack for the discharge of equipment and/or process room air. Each of these stacks is equipped with a continuous air sampling device. Buildings 50–01 and 50–69 also have two additional ventilation stacks each that are not continuously sampled.

Approximately 5 million gallons (20 million liters) of treated effluent are discharged annually from RLWTF into Mortandad Canyon via NPDES Outfall #051. Discharges from RLWTF into Mortandad Canyon have created a small wetland area near this outfall.

An estimated 3.68 million cubic feet (103,000 cubic meters) of chemical, radioactive, and mixed solid wastes were buried from 1948 to 1974 in 7 pits and 108 shafts in former Material Disposal Area (MDA) C. MDA C covers 11.8 acres (4.78 hectares), is completely fenced in, and is being investigated as part of LANL's ER Project. Disposal pits and shafts lie 1,300 feet (397 meters) above the main aquifer. Surface waters drain to the northeast into Ten Site Canyon, a branch of Mortandad Canyon. There is no evidence of migration of wastes from Area C (LANL 1992).

In response to the November 1997 report of the DOE Inspector General on the RLWTF (DOE 1997b), DOE prepared a "make or buy" analysis of radioactive liquid waste collection and treatment at LANL, focusing on possible privatization of the RLWTF. The DOE concluded that the continued operation of the RLWTF by LANL was the appropriate course of action (Gurule 1998).

Description of Capabilities

Capabilities and operations performed at the RLWTF include: waste characterization, packaging, and labeling; waste transport, receipt, and acceptance; waste storage; liquid waste pre-treatment and treatment; and material decontamination. Each of these is described below. The manner in which these activities would vary among the alternatives is described in chapter 3.

Waste Characterization, Packaging, and Labeling. Waste characterization is the process of identifying and quantifying constituents of concern in waste streams, accomplished in one of three ways. The first, process knowledge, uses information in lieu of sampling and analysis to characterize the waste. The second, radiological testing, employs techniques such as gamma spectroscopy, liquid scintillation, and passive/active neutron scanning to determine types and quantities of radionuclides in a waste.

The third is waste sampling and analysis, which depends on the ability to obtain representative samples and on analytical reproducibility. The three methods may also be used together when characterizing a waste stream.

DOT regulations specify what types of containers are acceptable for transporting each type of waste and labeling requirements for each type of container. Waste generators perform the initial packaging and labeling operations, but waste management personnel sometimes perform two other packaging operations. Waste may be overpacked to ensure container integrity (e.g., by placing a 55-gallon drum into an 85-gallon drum). Wastes can also be repackaged to reduce storage and transportation costs. In this operation, waste management personnel either combine the waste from a number of smaller containers into a single container, or place smaller containers of waste into a larger container.

Waste Transport, Receipt, and Acceptance. Liquid wastes travel from generator facilities to the RLWTF at TA–50 by one of thee modes. Most radioactive liquid wastes are sent via an underground pipeline system that transfers liquids directly to RLWTF influent tanks. Other generators, not connected by the underground pipeline system, transfer their wastes into a special tanker truck for delivery to the RLWTF. Generators of small quantities of radioactive liquid wastes drum their wastes, then truck the drums to TA–50.

Waste receipt and acceptance occurs with every shipment of waste to a waste management facility. Activities typically include visual inspection of vehicle and container, cross-checking container labels and shipment manifests, radiation surveys of the vehicle and containers, and weighing of vehicles, and/or containers.

Waste Storage. Liquid and solid chemical, radioactive, and mixed wastes are stored at both TA–50 and TA–54. At TA–50, wastes are stored within the RAMROD Facility, adjacent to the WCRR Facility, and within influent storage tanks at the RLWTF.

Radioactive Liquid Waste Pre-Treatment. Radioactive liquid wastes from TA–21 (described in section 2.2.2.2) are pre-treated at Building 21–257 using pH adjustment (using sodium hydroxide), flocculation (using calcium hydroxide, ferric sulfate, and a polymer), settling, and filtration. Radioactive liquid wastes from TA–55 (described in section 2.2.2.1) are pre-treated in the same fashion in Room 60 of the RLWTF at TA–50. Pre-treated streams are added to similar radioactive liquid wastes from all other LANL generators, then treated in the main process line of the RLWTF.

Radioactive Liquid Waste Treatment. Beginning in early 1997, the main process for treatment of radioactive liquid wastes employs ultrafiltration and reverse osmosis. Ultrafiltration typically removes solids and dissolved materials as small as 10 nanometers in diameter, while reverse osmosis will remove materials less than 1 nanometer in size. The newer technology also reduces the amounts of most chemicals required by the pre-treatment process (calcium hydroxide, ferric sulfate, and polymers are not required, and sodium hydroxide use is approximately halved). Once treated, effluent is discharged via NPDES Outfall 051. Solid wastes generated from treatment processes are shipped to TA–54 for appropriate storage or disposal. In the summer of 1998, process equipment for nitrate reduction will be installed to ensure compliance with recent changes to groundwater discharge limits. The new process will use biological denitrification to reduce nitrate concentrations to 10 parts per million or lower. The new process is expected to become operational in mid 1999.

Decontamination Operations. Decontamination is performed by waste management personnel either to enable re-use of an item or to re-classify the waste type. Both activities are used primarily to achieve waste volume reduction. An example of the former activity is the removal of radioactive surface contamination from lead bricks, thus enabling the bricks to be re-used as shielding. An example of the second activity is the sorting and segregating of a waste item or package into its components (e.g., hazardous and radioactive) so that the waste is no longer a mixed waste. Decontamination operations take place in Buildings 50–01 and 50–185.

2.2.2.15 Solid Radioactive and Chemical Waste Facilities (TA–54 and TA–50)

TA–50 houses some solid waste facilities (Figure 2.2.2.15–1) in addition to the radioactive liquid waste facilities described in section 2.2.2.14. At 943 acres (382 hectares), TA–54 is one of the larger technical areas at LANL (Figures 2.2.2.15–1 through 2.2.2.15–4). There are 120 structures within TA–54, of which 101 house waste management personnel and operations (Table 2.2.2.15–1). Approximately 130 workers are needed to perform these treatment, storage, and disposal operations. A variety of wastes are managed at TA–54, including industrial, toxic, hazardous, LLW, TRU, and mixtures of the above. Waste forms are solid except for small quantities of gaseous or liquid hazardous, toxic, and mixed wastes. Storage, disposal, and some treatment operations are conducted.

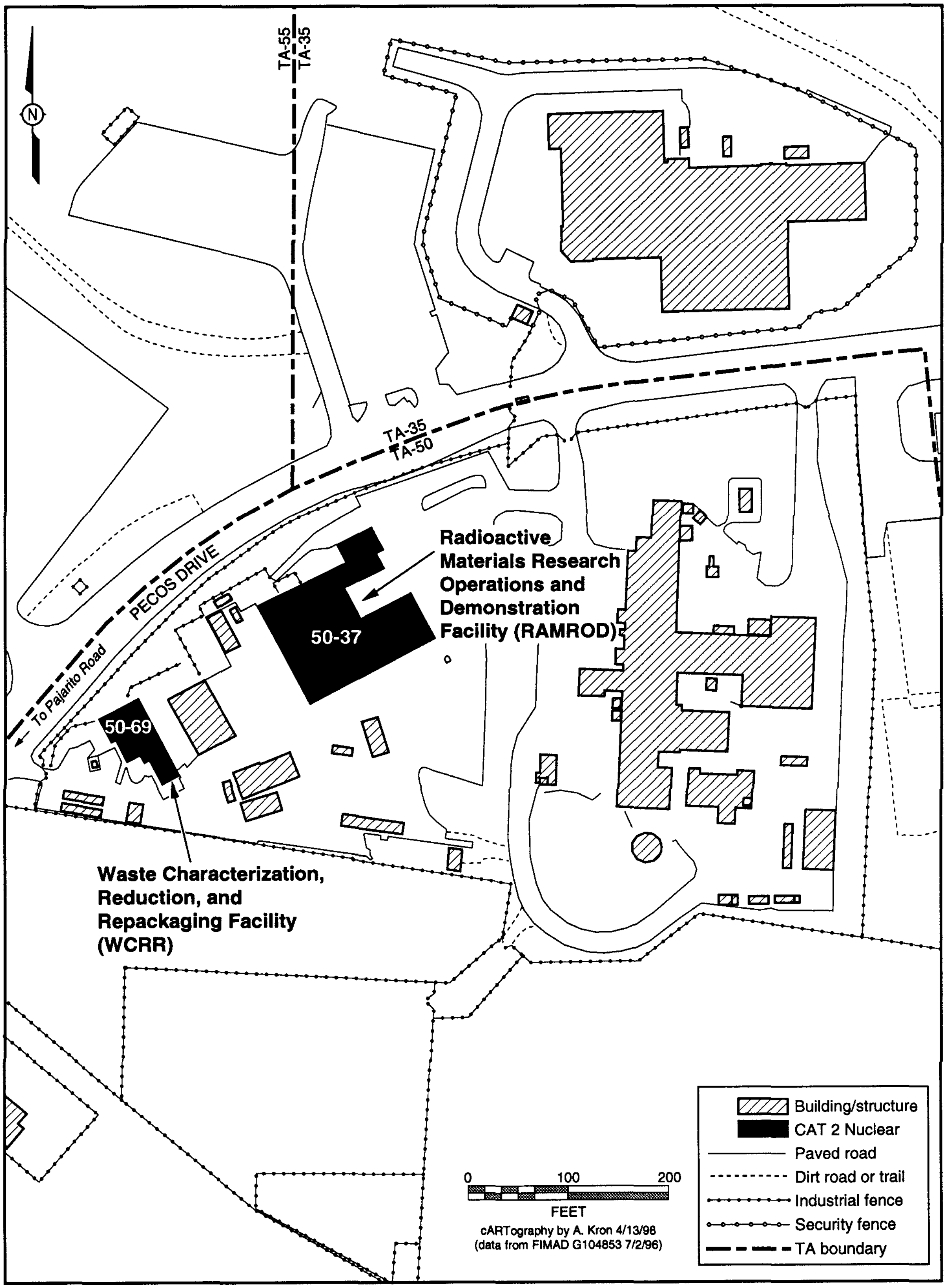


FIGURE 2.2.2.15–1.—*TA–50 Solid Radioactive and Chemical Waste Facilities.*

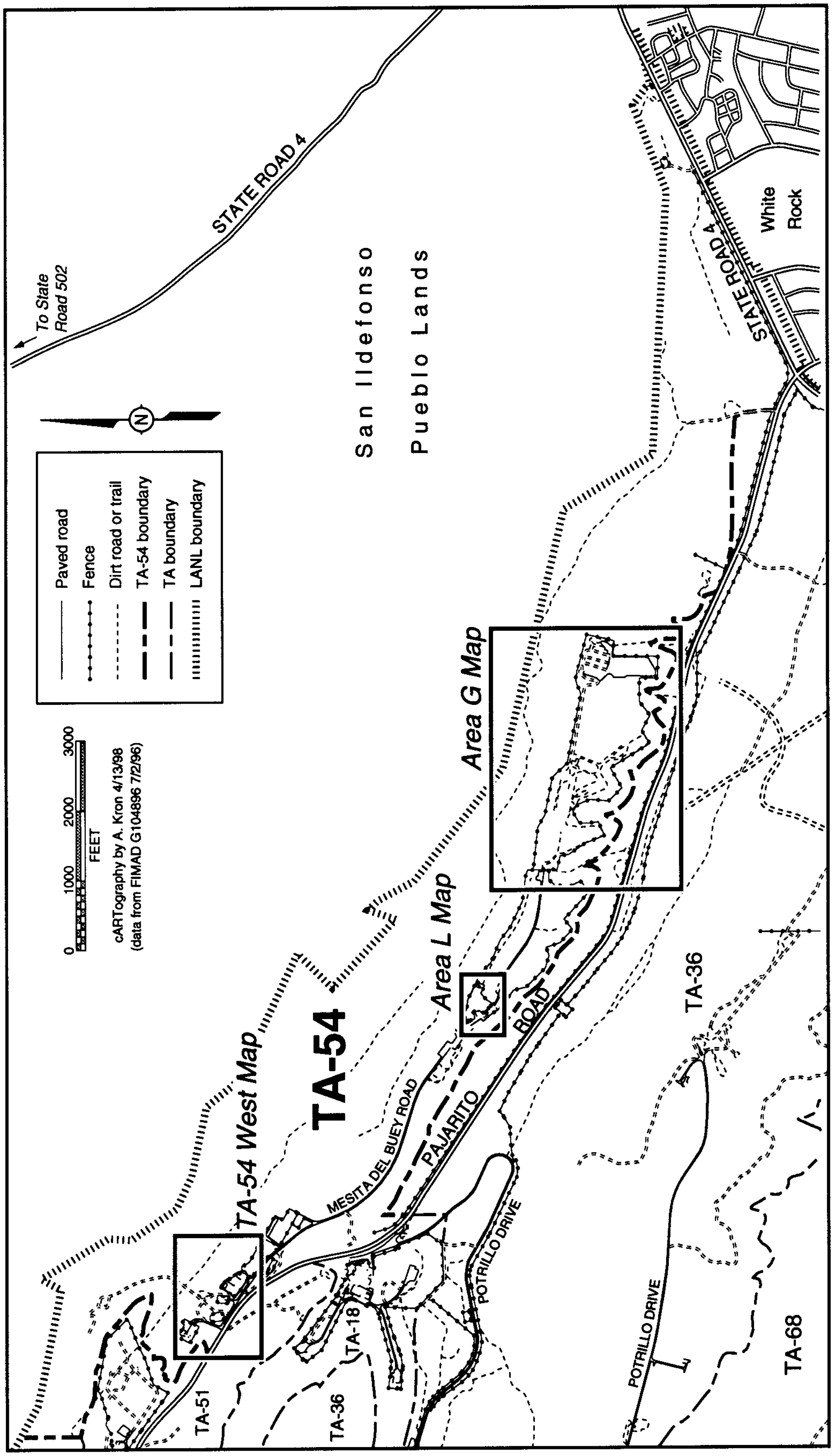


FIGURE 2.2.2.15–2.—*TA–54 Solid Radioactive and Chemical Waste Facilities.*

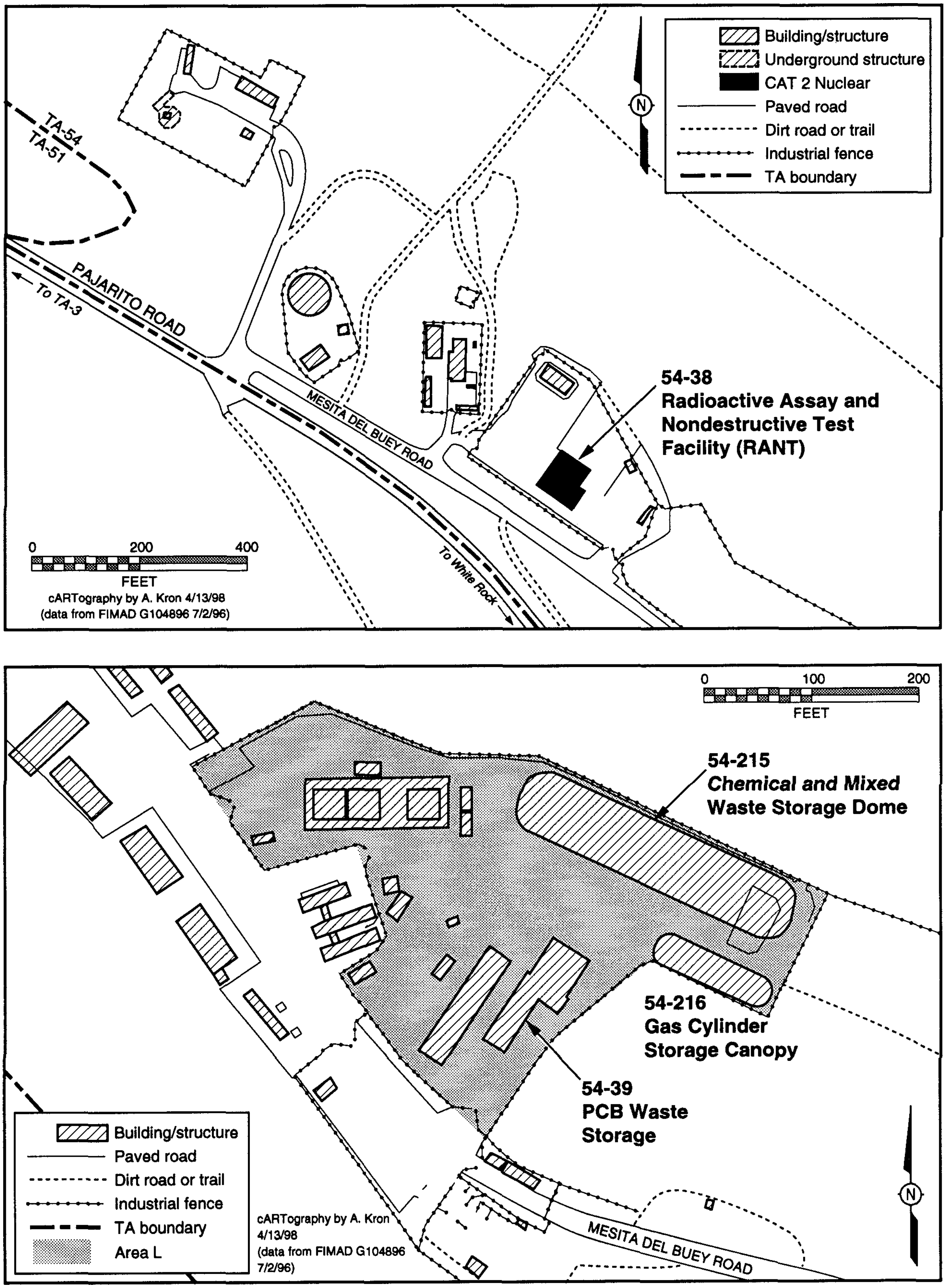


FIGURE 2.2.2.15–3.—*TA–54 Solid Radioactive and Chemical Waste Facilities.*

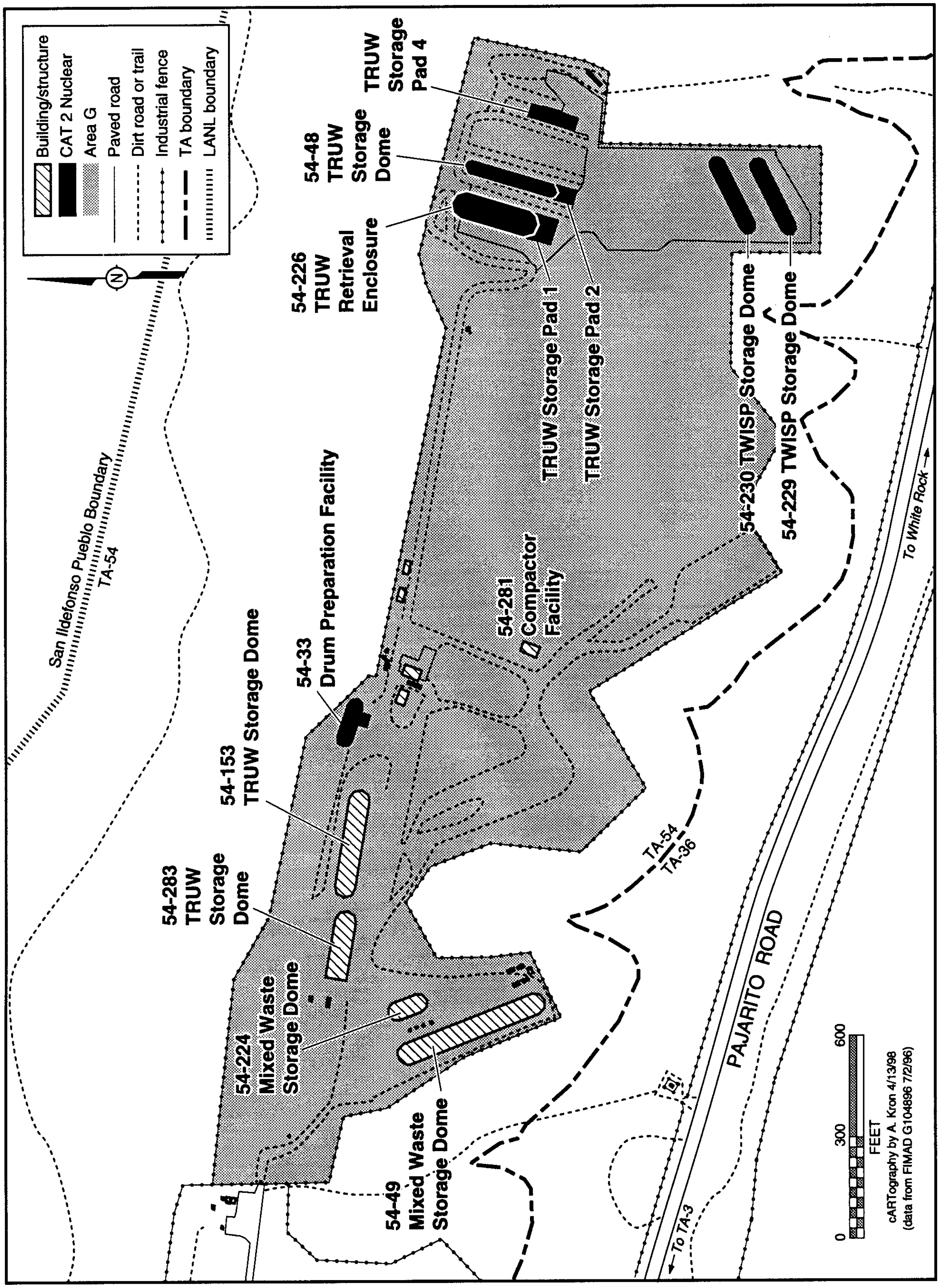


FIGURE 2.2.2.15–4.—*TA–54 Solid Radioactive and Chemical Waste Facilities.*

TABLE 2.2.2.15–1.—*Principal Buildings and Structures of the Solid Radioactive and Chemical Waste Facilities*

TECHNICAL AREA	PRINCIPAL BUILDINGS AND STRUCTURES
TA–50	Radioactive Materials Research, Operations, and Demonstration Facility: 50–37 Waste Characterization, Reduction, and Repackaging Facility: 50–69
TA–54	Drum Preparation Facility: 54–033 Radioactive Assay and Nondestructive Test (RANT) Facility: 54–038 PCB Storage Building: 54–039 TRU Waste Storage Domes: 54–048, 153, 283 Mixed Waste Storage Domes: 54–049, 215, 224 TRU Waste Retrieval Enclosure: 54–226 TRU Waste Storage Domes: 54–229, 230 Gas Cylinder Storage Canopy: 54-216 Earth-Covered Drums of TRU Waste: Pads 1, 2, 4 Compactor Facility: 54–281 Storage Dome for Supplies: 54–282

Description of Facilities

TA–54 West. The far west portions of TA–54 are the location for environment, safety, and health offices (Buildings 54–1001 through 54–1004), a research and development laboratory (Building 54–1009), and a potable water pumping station and chlorination facilities. None of these are waste management operations. TA–54 West is also the location of the Radioactive Assay and Nondestructive Test (RANT) Facility, Building 54–038, which is a Hazard Category 2 nuclear facility. This 6,900-square-foot (640-square-meter) structure is used to verify characterization data for unopened containers of TRU waste and solid LLW. Verification steps include container contamination surveys, container weighing, passive/active neutron assay to determine radionuclide content, and real-time radiography to confirm physical contents. RANT will also serve as the loading station for shipments of TRU waste to WIPP.

Area H. Radioactive wastes were disposed of in nine shafts between May 1960 and August 1986. (Historical information is insufficient to determine whether these wastes would be considered LLW or TRU waste under current classifications.) This 0.3-acre (0.12-hectare) site is now a Solid Waste Management Unit (SWMU) under the ER Project. Each shaft is 6 feet (1.8 meters) in diameter and 60 feet (18 meters) deep (with a capacity to hold 1,714 cubic feet [48 cubic meters] of wastes). This area was used for the disposal of classified wastes. Tritium contamination has been detected in soils adjacent to some of the shafts (LANL 1992). There are no aboveground structures at Area H.

Area J. Area J is 2.65 acres (1.07 hectares) in size and has been used since 1961 for the disposal of industrial solid wastes. The area has six disposal cells and four disposal shafts. Cells 1 and 2 are filled and capped with soil. Cell 3 is filled and capped with asphalt, and an asbestos transfer station is located on the asphalt. Cells 4, 5, and 6 are open. Two of the four shafts are filled and capped with concrete. Shafts 3 and 4 are less than 10 percent filled. Shafts are 6 feet (1.8 meters) in diameter and 60 feet (18 meters) deep, while pits vary in size (LANL 1992).

Disposal operations have interim status under RCRA, subtitle D, from the State of New Mexico. Five waste management operations are conducted at Area J:

- Administratively controlled industrial solid wastes (e.g., paper trash containing personnel information or contracts) are disposed. Three disposal cells are open; three have been filled to date. Waste volumes have been shrinking the past several years, and there is enough disposal capacity in the three unfilled cells for at least another 8 years of operation.
- Previously hazardous wastes. In the past, barium-contaminated soils were neutralized at TA–54, Area L, then disposed of at Area J in the same cells as industrial wastes. The last such disposal occurred in October 1993.
- Classified industrial wastes are disposed in shafts. There are four shafts, each 60 feet (18 meters) deep and 5 feet (1.5 meters) in diameter. Two of the shafts are filled and two nearly empty.
- Asbestos wastes are stored prior to shipment to a permitted asbestos disposal facility. Two roll-off containers are used to store friable asbestos wastes; nonfriable asbestos wastes are stored on an asphalt pad.
- Oil-contaminated soils are land farmed under an interim permit from the State of New Mexico. Soil is turned periodically, and soils are sampled for hydrocarbon content. The land farm covers an area of 8,200 square feet (763 square meters) (0.2 acre [0.08 hectare]) between Cells 1 and 6. Oil-contaminated soils have not been added to the land farm area since September 1992.

There are a number of storage sheds and a storage dome (Building 54–282) at the entrance gate to Area J. These hold supplies for all waste management operations at TA–54.

Area L. Area L is a 2.65-acre (1.07-hectare) operations site that is paved and fenced. Formerly used for the disposal of chemical wastes, the area is now used for receipt, storage, and shipment of *Toxic Substances Control Act* (TSCA), RCRA, and mixed wastes. These include hazardous waste (HW) (gaseous, liquid, and solid), PCB wastes (solid and liquid), liquid LLMW, and irradiated lead stringers from TA–53 (described in section 2.2.2.11).

Important structures within Area L are discussed below.

- *Liquid LLMW Storage Building 54–215.* This is a large (16,000-square-foot [1,490-square-meter]), new structure used for storing drums of LLMW. The building has a bermed asphalt floor, an unfiltered exhaust stack, interior lighting, and an overhead fire suppression system.
- *Gas Cylinder Canopy 54–216.* This one-walled, roofed facility (4,000 square feet [370 square meters]) is used to store gas cylinders until they can be shipped off site for treatment and disposal.
- *PCB Building 54–039 and Attached Canopy.* Liquid and solid PCB wastes are stored until they are shipped off site for treatment and disposal. Some of the waste liquids are also contaminated with hazardous and/or radioactive wastes.
- *Liquid Chemical Waste Storage Canopy 54–032*. Drums of liquid chemical wastes are segregated for compatibility, then stored in the appropriate section of this open structure.
- *Laboratory Pack Storage Units 54–068, 54–69, and 54–70*. Small quantities of HW are placed in 5-gallon (19-liter) laboratory packs. Laboratory packs are segregated for compatibility, then stored in these small sheds until shipped for treatment and disposal. Storage units are equipped with secondary containment.

- *Sampling, Shipment, and Treatment Canopies 54–058, 54–36, 54–35.* These sheltered pads have an overhead covering, but no sides. Canopy 54–035 contains two treatment tanks that are currently not in use. Canopy 54–036 holds equipment used to survey and sort mixed wastes.

Because Area L is covered with asphalt, stormwater is directed to a single outfall that discharges into Cañada del Buey at the northeast corner of the liquid LLMW storage dome 54–215. An overflow weir is used to measure discharge flow rates and volumes.

Chemical wastes were disposed of at Area L from the 1950's until December 1986. Inactive disposal units include 1 cell, 3 surface impoundments, and 34 shafts, with a total disposal capacity of 71,540 cubic feet (2,004 cubic meters) (LANL 1992). Noncontainerized solids and drummed, but without absorbent, liquids were disposed of in the unlined pit and shafts. Unlined surface impoundments B and C were used to evaporate treated salt solutions such as ammonium bifluoride and electroplating waste solutions. Unlined impoundment D was used to react lithium hydride with water and also served as secondary containment for waste oil tanks. This area is now being investigated under the LANL ER Project as part of Operable Unit 1148. To date, cadmium, chromium, and volatile organics have been detected in subsurface soils.

Area G. Area G is used principally for the disposal of solid LLW and the storage of TRU waste. Some LLMW is also currently stored in one part of Area G. Also, Area G has EPA approval for disposal of PCB waste (greater than 50 parts per million) in either disposal cells or shafts. However, only solid radioactively contaminated PCB waste may be disposed in Area G. Stabilized PCB waste also may be disposed, provided it has been stabilized in accordance with EPA requirements. Some treatment of LLW and TRU waste also takes place (e.g., compaction or other nondestructive volume reduction technologies). The legacy inventory buried at Area G includes TRU waste disposed of prior to 1971 and LLMW disposed of prior to the promulgation of RCRA in 1986. Important structures within Area G are presented in the PSSC analysis of the Expansion of Area G (see volume II, section I.1) and summarized below.

Disposal Cells and Shafts. At present, subsurface disposal units include 35 cells, approximately 260 shafts, and 4 trenches (Krueger 1994). The Area G disposal facility (Figure 2.2.2.15–5) has been a disposal site for LANL's solid radioactive waste since 1957, and is currently the only active disposal site for LLW.

Five cells (15, 31, 37, 38, 39) are currently in use. These five have a remaining disposal capacity of about 928,200 cubic feet (26,000 cubic meters). The existing footprint for Area G disposal operations has space for new cells that would add capacity for about another 357,000 cubic feet (10,000 cubic meters) of wastes. Continued disposal at TA–54 would require expansion of disposal operations beyond the current footprint. Alternatively, wastes would have to be packaged and shipped for off-site disposal.

Temporary Retrieval Dome, Building 54–226. This large (approximately 21,000 square feet [1,950 square meters]) fabric-covered dome structure is the site of the TRU Waste Inspectable Storage Project (TWISP), a multi-year project in which approximately 17,000 earth-covered containers of TRU waste will be retrieved, characterized, and placed into aboveground storage facilities. The dome provides an enclosure and weather protection for workers and is equipped with a ventilation system and HEPA filters. It will be dismantled and re-erected as retrieval operations proceed through TRU waste storage Pads 1, 2, and 4.

Drum Preparation Facility, Building 54–33. This facility has bays for steam cleaning and for

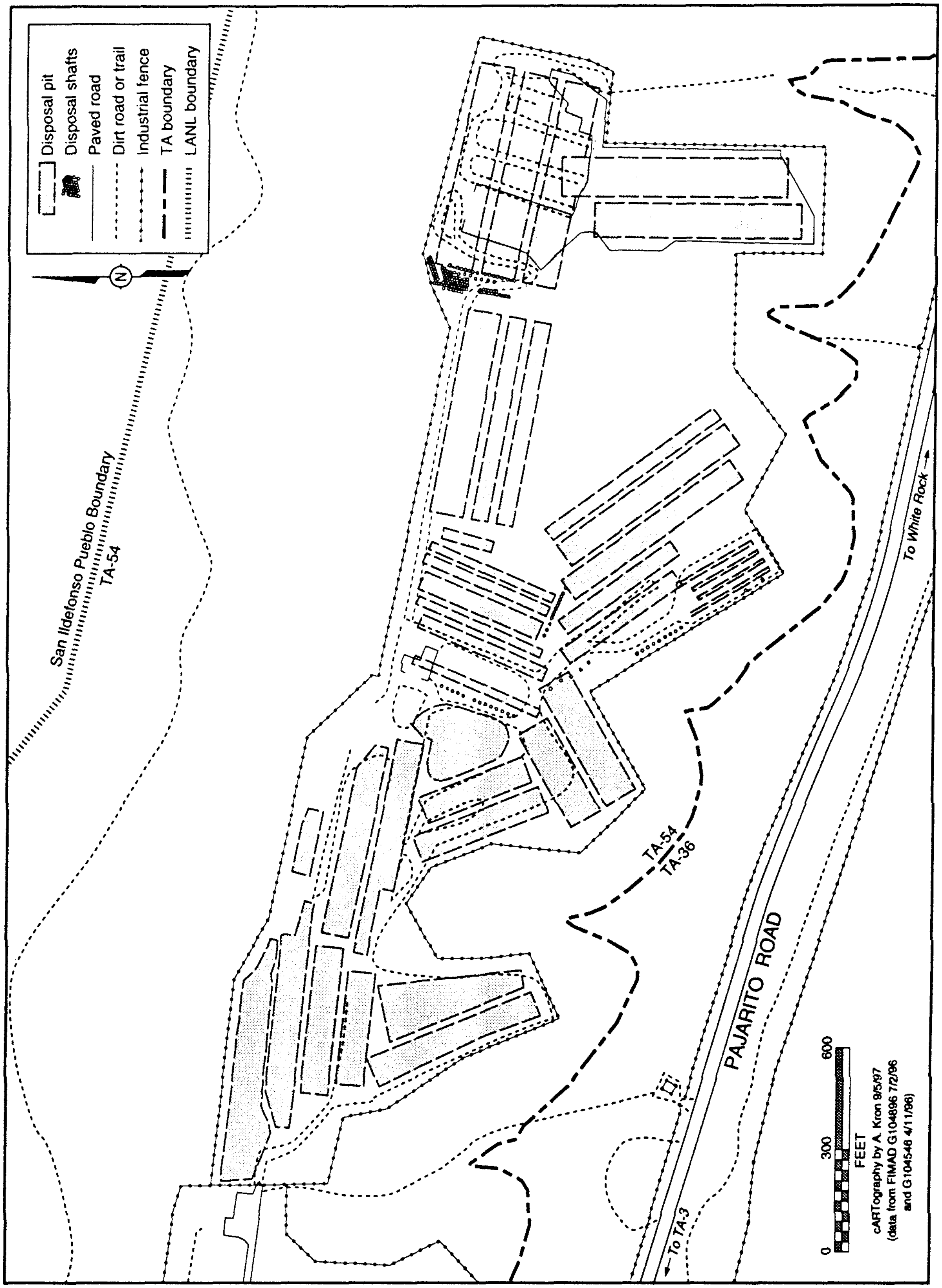


FIGURE 2.2.2.15–5.—*TA–54 Area G Disposal Cells.*

painting drums of TRU waste retrieved during TWISP, associated water sedimentation pits and collection tanks, a drum venting system to safely puncture and vent retrieved drums of TRU waste, and a general treatment bay with modular containment for size reduction of gloveboxes and similar large waste items, and for waste segregation.

Compactor Facility, Building 50–281. This building houses a waste compactor with 200 tons (180 metric tons) of compressive force, which can achieve volume reductions as great as 8 to 1. Compacting waste helps to conserve disposal space and minimizes soil subsidence at the disposal cell. A smaller compactor is used to crush items such as empty drums.

Waste storage facilities. Area G also includes:

- Tension Support Buildings 54–049 and 54–224 for solid LLMW
- Sheds 54–144, 145, 146, and 177 for mixed tritiated wastes
- Tension Support Buildings 54–048, 153, and 283 for newly generated TRU waste
- Storage Domes 54–229 and 230 (16,000 square feet [1,488 square meters] each) for legacy TRU waste retrieved during TWISP

Storage Pads 1, 2, and 4. These asphalt pads hold legacy TRU waste in drums and other containers. Pads and containers were covered with earth during the 1970's and 1980's. Wastes are to be retrieved and placed into above-surface storage domes so that RCRA inspection requirements can be met and so that wastes and containers are in a form suitable for disposal. A total of six storage domes will be required; two were constructed in 1995 and four more are planned. The domes are 280 feet (85 meters) long, 60 feet (18 meters) wide, and 40 feet (12 meters) high and can store about 3,000 drums of waste. (This action was categorically excluded from further NEPA review.)

An asphalt pad adjacent to Building 54–049 is used for the outdoor storage of pyrophoric uranium waste chips.

Other structures at TA–54 include:

- *54–002*—maintenance shop
- *54–011*—offices and a personnel decontamination shower facility
- *54–020, 54–079, and 54–092*—equipment shelter canopies

TA–50. TA–50 is the location of RLWTF for the treatment of radioactive liquid wastes as described in section 2.2.2.14. TRU wastes, however, are processed in two facilities in TA–50 and then transported to TA–54 for storage.

WCRR Facility, Building 50–069. This is a nuclear facility that is used to size reduce large TRU waste items such as gloveboxes. Waste items are stored outdoors, brought into the building through a vehicle air lock, then introduced into a cutting enclosure (glovebox). A plasma cutting torch is used to section large waste items and the smaller pieces are loaded into standard waste boxes. Clean-up liquids are piped to the RLWTF in Building 50–01 through a filter and storage system that allows characterization of the liquids prior to transfer. A second operation is the visual inspection of the contents of TRU waste drums that have already been characterized. This visual inspection is performed on a statistical percentage of drums and provides a quality assurance overcheck of the TRU waste characterization program.

RAMROD Facility, Building 50–037. An incinerator for PCBs and combustible hazardous wastes was formerly housed in this facility. Re-named the RAMROD Facility, Building 50–037 is a candidate Hazard

Category 2 nuclear facility. Equipment for the characterization of TRU waste has been installed and is expected to be operational by mid 1998. The RAMROD Facility is also a general host for any other process that requires the containment and controls of a nuclear facility.

Description of Capabilities

Capabilities required for the management of solid radioactive and chemical wastes include waste characterization, packaging, and labeling; waste transport, receipt, and acceptance; and waste storage and disposal. In addition, compaction, size reduction, waste retrieval, and other treatment operations are performed. Each of these activities is described below. (Additional information on waste management facilities and operations is included in *Waste Management Strategies for LANL* [LANL 1998b]). The manner in which they would vary among the alternatives is described in chapter 3.

The RAMROD Facility is being considered as an alternative for Lead Test Assembly and inspection operations in the *Surplus Plutonium Disposition Environmental Impact Statement* (DOE 1998a; section 1.5.8). This activity includes the receipt and inspection of MOX fuel rods that would be fabricated at the Plutonium Facility Complex (described in section 2.2.2.1), assembled into bundles, inspected, and shipped off site. Such operations would constitute a new capability at RAMROD. The impacts associated with implementing this proposal are described in chapter 5, section 5.6. This addition would change the amount of material in the facility (plutonium/uranium MOX) and increase shipments of nuclear materials to and from LANL, as compared to the SWEIS Expanded Operations Alternative.

Waste Characterization, Packaging, and Labeling. This is similar to the activities described under this heading in section 2.2.2.14. At TA–54, this activity includes characterizing and certifying that TRU wastes comply with waste acceptance criteria (WAC) for WIPP. Activities specific to WIPP WAC include drum venting, core sampling, and visual inspection.

Drum Venting. Drums containing TRU-contaminated hydrogenous materials such as plastic and cellulose could accumulate hydrogen gas through radiolytic decomposition of the waste matrix or packaging material. Accordingly, WIPP WAC specify that all waste packages be vented with one or more specified filters. Nondegraded drums retrieved during the TWISP are processed through the drum venting system at the Drum Preparation Facility, Building 54–33. The system safely vents containers up to 55 gallons (208 liters) in size and installs a filter vent in each.

Core Sampling. In a glovebox in the RAMROD Facility, samples will be cored from solidified TRU waste in order to analyze the chemical composition of wastes that have been solidified.

Visual Inspection. At the WCRR Facility, waste packages are opened, sampled, and examined, and the condition of the packages themselves is evaluated. Any items determined to be noncompliant are removed. A similar glovebox will be placed into operation in the RAMROD Facility. This characterization step is performed on a percentage of already-certified TRU waste packages to verify stated contents.

Compaction. Solid LLW is compacted in Building 54–281 at Area G. The compactor uses a hydraulic piston to generate 200 tons (180 metric tons) of compressive force, achieving waste volume reductions as great as 8-to-1. Compacting provides improved waste package integrity, minimizes soil subsidence at the disposal pit, and conserves disposal space. The process also confirms that there are no trapped or interstitial liquids within the waste package. Building 54–281 is also equipped with a smaller compactor that can be used to crush items such as empty drums.

Size Reduction. Size reduction operations occur within the WCRR Facility at TA–50 and the Drum Preparation Facility at TA–54. The WCRR Facility is operated for the purpose of sectioning (to reduce volume) and repackaging bulky TRU-contaminated metallic waste into containers approved for shipment to WIPP. The interior of the WCRR Facility consists of a large (6,790-cubic-foot [190-cubic-meter]) ventilated enclosure in which discarded gloveboxes and other TRU waste items are cut apart with a plasma torch. Waste items are staged in an outside storage area, brought into the building through an air lock, unpacked, and then moved into the main enclosure. At the Drum Preparation Facility, modular containment is used for size reduction operations.

Waste Transport, Receipt, and Acceptance. Containers for transport of solid wastes vary widely, and depend upon the waste, its destination, and transport regulations. Solid radioactive wastes, for example, are transported on site in drums, dumpsters, crates, or specially designed shielded packages. Periodically, containers other than DOT-specified containers may be used for some on-site shipments, provided the transport route is controlled (i.e., by road closure) during transport. Off-site transport of waste may require additional preparations. DOT-specified packages must be used for off-site transport, and waste must be certified to meet the WAC of the receiving facility.

Waste receipt and acceptance activities typically include visual inspection of the vehicle and the container, cross-checking container labels and shipment manifests, radiation surveys of the vehicle and containers, and weighing of vehicles and/or containers. These activities include receipt and acceptance of small quantities of off-site LLW and TRU waste.

Waste Storage. At TA–50, wastes are stored within the RAMROD Facility and adjacent to the WCRR Facility. At TA–54, chemical wastes are stored at Areas J and L until sufficient quantities are accumulated for a shipment to off-site treatment, storage, and disposal facilities. Because they are used only to store items prior to processing or shipping, however, these storage areas are small in comparison to those at TA–54 for storage of LLMW and TRU waste. LLMW and TRU waste represent the vast majority of wastes in storage and are stored in large fabric-covered domes within Area L (Dome 54–215) and Area G (seven domes). This activity includes the storage of small quantities of waste from off site.

Waste Retrieval. Between 1979 and 1991, LANL stored packages of TRU waste on three pads at the east end of Area G, then placed the containers under earthen cover. Because some of these packages contained mixed TRU waste, they are subject to RCRA and its requirements for periodic container inspection and response to emergency conditions. Accordingly, LANL has developed the facilities and capability to retrieve these wastes, repackage and characterize them, and place the wastes into new, aboveground storage domes.

The operation begins with the construction of the retrieval enclosure (Building 54–226) atop a storage pad. Containers are removed as earth is cleared away. Degraded containers will be overpacked, repaired, or secured by wrapping in plastic or by banding with metal straps. Nondegraded drums are transported to the adjacent Drum Preparation Facility (Building 54–33), where they will be vented using the drum vent system and then steam-cleaned, re-painted, and re-labeled as needed. Retrieved containers will then be characterized and certified to meet the WIPP WAC.

Other Waste Processing. Several treatment operations occur periodically or in small scale at LANL facilities for solid radioactive and chemical wastes. Solidification of TRU sludges is performed at the RLWTF (described in section 2.2.2.14). Sludges are mixed with cement in 55-gallon (208-liter) drums, allowed to cure, then transported to Area G for storage (prior to eventual shipment to WIPP).

Stabilization of pyrophoric uranium chips is periodically performed in a permacon on the asphalt pad adjacent to Building 54–049 in Area G. Chips, and the oil in which they are immersed, are mixed with a chemical agent to produce a gel. Thus stabilized, the uranium is then disposed of in disposal cells at Area G.

Electrochemical treatment of LLMW is performed at RAMROD. This is a demonstration project involving two pilot-scale treatment units. Solutions containing low levels of metals, nitrates, sulfides, and/or organics will be subjected to electric current. Metals will be electrochemically deposited on cathodes; sulfides will precipitate out of solution; and organics will oxidize to carbon dioxide and water. The remaining solution will contain low levels of radioactivity and be managed as a radioactive liquid waste. Other research and development on possible treatments for LLMW, including electrochemical and other currently undefined technologies, may also be performed at RAMROD as demonstration projects. Pilot-scale treatment units will be used, and small quantities of wastes will be processed.

Limited treatment of hazardous wastes is performed at Area L. This typically consists only of chemically treating characteristic hazardous wastes. Treatment of cylinders of gases has also been performed in the past.

As discussed under “Description of Facilities” earlier in this section, land farming of oil-contaminated soil is performed at Area J.

Disposal. Disposal operations are performed only at Area G and Area J. Solid LLW is disposed of at Area G in cells and shafts. Solid industrial wastes are disposed of at Area J.

At Area G, cells are generally rectangular excavations to a depth of 66 feet (20 meters), constructed in accordance with guidelines established by the U.S. Geological Survey and the Area G Performance Assessment (LANL 1998d). Each layer of waste is covered with a layer of backfill that is 6 to 12 inches (15 to 30 centimeters) thick. When nearly full, the upper 2 meters of each cell is filled with crushed tuff, mounded over with topsoil, and then re-vegetated. Approximately 20 to 25 percent of the pit volume is filled with LLW, and the remainder is either void space or tuff/soil backfill. Five cells are currently open and in use. Four of these receive solid LLW and one receives asbestos wastes that have radioactive contamination.

At Area G, shafts range from 1.0 to 8 feet (0.3 to 2.5 meters) in diameter and up to 66 feet (20 meters) in depth and are covered with a concrete plug. Shafts, readily capped until the next shipment of waste is received, are dedicated to specific types of waste such as solid LLW with activity greater than 1 rem per hour, tritiated wastes with activity greater than 20 microcuries per cubic meter, radioactive biological wastes, radioactive PCB wastes, radioactive beryllium wastes, and radioactive classified wastes.

Lesser volumes of administratively controlled industrial solid wastes and formerly characteristic wastes are disposed at the Area J landfill. The majority of these wastes are disposed in cells, where wastes are daily covered with backfill. Nonradioactive classified wastes are disposed in shafts in Area J.

Disposal activities include the disposal of small quantities of LLW from off-site locations (discussed further in section 4.9.3).

While LANL does not currently have any sites designated for disposal of LLMW, the WM PEIS (DOE 1997c) considers LANL as an alternative regional disposal site for this type of waste. If selected, LANL would have to establish a LLMW disposal capability, as well as WAC for LLMW and would identify candidate sites for disposal. The WM PEIS indicates that up to 2,263,000 cubic feet (64,100 cubic meters) of such waste could be designated for disposal at LANL over the next 20 years. The actual amount that would be disposed of at LANL, if selected, is highly dependent on the WAC, actual waste generation, and the sites identified that would ship such waste to LANL. As such, the siting and sizing of such a capability is highly uncertain and is not analyzed in the SWEIS.

2.2.3 Nuclear and Moderate Hazard Facilities Not Analyzed as Key Facilities

This section identifies LANL facilities that are designated as nuclear or moderate hazard facilities, but that do not meet the criteria for key facilities described in section 2.2.2 of the SWEIS. These facilities include those that are operating and several that are surplus and awaiting decontamination and decommissioning following removal of SNM and hazardous materials. No substantial change is anticipated in the future operations or impacts associated with these facilities.

As noted previously, there are no Hazard Category 1 nuclear facilities at LANL. Hazard Category 2 nuclear facilities (those for which a hazard analysis shows the potential for significant on-site consequences) that did not meet the criteria for key facilities are discussed in section 2.2.3.1. Hazard Category 3 nuclear facilities (those for which a hazard analysis shows the potential for only significant localized consequences) that did not meet the criteria for key facilities are discussed in section 2.2.3.2. Nonnuclear moderate hazard facilities that do not meet the criteria for key facilities are discussed in section 2.2.3.3

2.2.3.1 *Hazard Category 2 Nuclear Facilities*

The Source Storage Building (TA–3 Building 65) was given a Hazard Category 2 classification because of the presence of encapsulated radioactive materials and SNM used for research and measurement activities. All radioactive sources and SNM are sealed in steel containers that are never opened.

In addition, the Omega West Reactor (TA–2 Building 1) has been placed in permanent shutdown. All SNM and hazardous materials have been removed from the facility. The facility is surplus and was reclassified from a Category 2 nuclear facility to a low hazard radiological facility.

2.2.3.2 *Hazard Category 3 Nuclear Facilities*

The following are Hazard Category 3 nuclear facilities that do not meet the criteria for key facilities:

- *Calibration Building (TA–3 Building 130)*—The Calibration Facility is designated as a Hazard Category 3 nuclear facility due to the radioactive source inventories stored in the building. The primary functions of this facility are performing radiation evaluation studies involving sealed radiation sources; calibrating instrumentation; and evaluating the response of various detectors to x-ray, gamma, beta, and neutron emissions. Activities do not include processing of nuclear material because radioactive sources are sealed at all times.
- *Portion of Physics Building (TA–3 Building 40)*—The Health Physics Instrument Calibration facilities, located within the Physics Building, are designated a Hazard Category 3 nuclear facility because of the radioactive materials and SNM used in the laboratories for instrument calibration, as

well as the radioactive and SNM source inventories that are stored in the two storage vaults. The primary function of this facility is the calibration and evaluation of all types of radiation detection instrumentation used throughout the laboratory. The instrumentation includes alpha, beta-gamma, neutron, and tritium gas detectors.

- *High Pressure Tritium Facility (TA–33 Building 86)*—This building is an old high-pressure tritium handling facility that is currently in safe shutdown mode pending decontamination and decommissioning. Upon completion of decontamination and decommissioning activities, the facility is expected to have radionuclide inventories below threshold quantities, which, in turn, will result in the facility being downgraded from its current Hazard Category 3 classification.
- *Nuclear Safeguards Research Facilities (TA–35 Buildings 2 and 27)*—These facilities are classified as Hazard Category 3 nuclear facilities because each facility contains an SNM storage vault. All radioactive sources and SNM are encapsulated or in sealed containers that prevent contamination to the workers and facility. Uranium is singly contained, while plutonium is doubly contained within this facility. The primary mission of both facilities is to support nonproliferation and international security activities; however, other research and development activities include various studies of radiation effects on materials in support of fusion, ceramic science, and technology programs.

2.2.3.3 *Nonnuclear Moderate Hazard Facilities*

The following are nonnuclear moderate hazard facilities that do not meet the criteria for key facilities:

- *Various Chlorination Stations (TA–0 Buildings 1109, 1110, 1113, 1114; TA–16 Building 560; TA–54 Building 1008; TA–72 Building 3; TA–73 Building 9)*—These facilities are designated moderate chemical hazards because they are all gas chlorination stations where the potable water supply for the Los Alamos townsite and LANL is chlorinated.
- *Sewage Treatment Plants (TA–46, Building 340)*—The sewage plants are designated as moderate chemical hazard facilities because of the historical use of chlorine gas to disinfect plant effluent prior to its release to holding ponds. (Building 340 is a chlorine storage building.) These are being replaced currently by a new process not requiring the use of gaseous chlorine.
- *Liquid and Compressed Gas Facility (TA–3 Building 170)*—All toxic materials have been removed from this facility. A reclassification to a low chemical hazard status is pending.
- *Laboratory (TA–21 Buildings 3 and 4)*—Current activity at this facility includes radiochemistry operations in the laboratory areas of Buildings 3 and 4 North. Buildings 3 and 4 South had decontamination and decommissioning activities begin in 1994, with eventual decontamination and decommissioning activity to be performed at Building 3 North pending funding.
- *Laboratory Building (TA–41 Building 4)*—The facility is a laboratory called the Icehouse, where past operations included the handling and storage of materials such as uranium, tritium, deuterium, and liquid nitrogen. All nuclear materials were removed from this facility in 1995. The work currently performed in this facility consists of nonradiological work related to weapons engineering.

2.3 The Role of the University of California in LANL Activities

The U.S. Government, through DOE, owns all the land, buildings, and equipment at DOE facilities, including LANL. DOE contracts with commercial and academic entities for facility operations, a relationship referred to as government owned, contractor operated. The UC manages LANL for DOE and has continuously operated this facility since its creation during World War II. As LANL is managed by a nonprofit entity, UC, its operating budget is not subject to state or local gross receipts taxes.

The management and operating contract between DOE and UC has been renegotiated numerous times. The most recent 5-year contract was signed in October 1997.

The UC contract contains specific performance measures (i.e., criteria by which DOE evaluates the success of the operator). These performance criteria are reviewed and modified annually. Based on the results of performance appraisals for LANL and two other DOE sites (Lawrence Berkeley National Laboratory and Lawrence Livermore National Laboratory), UC will receive a performance fee that can be used for any operating costs from these laboratories not otherwise reimbursed by the government or for discretionary research by or at these laboratories.

The UC contract is administered by DOE through the DOE Los Alamos Area Office and the Albuquerque Operations Office. Major subcontractors to UC under this contract include Johnson Controls World Services, Inc., Protection Technology Los Alamos, and Bechtel Nevada.

In response to DOE requests for information, UC has provided data projections and descriptive information that has been relied upon as source material for this SWEIS. This includes background information on the history of LANL, information regarding funding, information regarding the buildings at LANL and their hazards, and detailed information regarding the operations within each of the key facilities. UC has compiled such information in several documents that were published to correspond with the publication of the draft SWEIS. These documents are cited throughout the SWEIS (particularly in chapter 5) and are available in hard copy at the LANL Community Outreach Center in Los Alamos. The titles, LANL document numbers, and web site of those documents are:

- *Waste Management Strategies for Los Alamos National Laboratory - 1997*, LA-UR-97-4764, http://lib-www.lanl.gov/la-pubs/00412794.pdf (LANL 1998b)
- *Overview of Los Alamos National Laboratory - 1997*, LA-UR-97-4765, http://lib-www.lanl.gov/la-pubs/00412795.pdf (LANL 1998a)
- *Description of Technical Areas and Facilities at Los Alamos National Laboratory - 1997*, LA-UR-97-4275 (LANL 1998c)
  - — Part I: http://lib-www.lanl.gov/la-pubs/00412796.pdf
  - — Part II: http://lib-www.lanl.gov/la-pubs/00412797.pdf

A popular Los Alamos publication web site is http://lib-www.lanl.gov/pubs/la-pubs.htm.

2.4 Recent LANL Funding Levels

Table 2.4–1 shows recent and projected funding levels for DOE and non-DOE activities by major budget category. This information, requested by commentors through the scoping process, is provided for context to indicate current sponsors and users of LANL facilities and expertise. While funding levels for programs may change, the expertise and types of operations are expected to remain relatively constant.

TABLE 2.4–1.—*LANL Consolidated Funding Summary (Fiscal Year 1994 to Fiscal Year 1998)*

PROJECTS	CONSOLIDATED FUNDING (MILLIONS)				
	ACTUAL COSTS				FUNDING PROJECTIONS
	1994 (9/30/94)	1995 (9/30/95)	1996 (9/30/96)	1997 (9/30/97)	1998 (3/04/98)
DOE OPERATING FUNDS					
Defense Activities	430	446	488	563	631
Nonproliferation/International Security	85	77	88	101	112
Materials Disposition[a]	0	0	10	21	28
Environmental Restoration and Waste Management	217	210	148	134	154
Energy Research	95	92	65	71	65
Nuclear Energy	13	17	18	18	14
Civilian Radioactive Waste[b]	17	10	0	0	0
Energy Efficiency	15	14	11	13	11
Science Education and Technology	1	1	1	0	0
Other DOE	9	14	12	8	10
Subtotal DOE	882	881	841	929	1,025
REIMBURSABLE OPERATING FUNDS					
DoD	82	71	52	54	44
U.S. Nuclear Regulatory Commission	3	2	2	3	1
Intelligence	18	14	10	12	10
Remaining Reimbursable Work[c]	70	113	103	108	108
Subtotal Reimbursable Work	173	200	167	177	163
Total Operating Funds[d]	1,055	1,081	1,008	1,106	1,188
CAPITAL/CONSTRUCTION FUNDS					
Total	109	102	102	143	149

[a] Prior to 1996, funding in this area was included in Defense Activities funding.
[b] Included in Remaining Reimbursable Work after 1995.
[c] Includes DOE Reimbursable Work.
[d] Operations that are capitalized are included in Capital/Construction Funds.

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